ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 25. No. 10. WEEKLY. | NEW YORK, WEDNESDAY, SEPTEMBER 5, 1894. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1894, by ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

Tommy Todd, aged nine years, of Philadelphia, tried the experiment of climbing up an electric light pole to investigate the working of the light at the top one evening last week. With his finger he touched the light and received a shock which sent him headlong to the ground. He was picked up with a cut head and taken to the hospital.

McEvers Bayard Brown, an eccentric New York millionaire, has lived almost a hermit's life on his palatial yacht "Valfreyia," which has been anchored in the harbor of Brightlingsea, a little fishing village on the Essex coast of England, for five years past. The "Valfreyia" is fitted out in princely fashion, and her equipment includes an electric light plant, which her owner keeps going night and day. He will never permit himself to be left in darkness even when asleep. Several times he called up his chief engineer and tried to make him confess that he had used the apparatus to charge the whole ship and her owner with electricity. Finally he declared he would stand it no longer, and after requiring one or another of the crew to pound the electricity out of him by heavy massage for several hours at night, Mr. Brown sent to London for an electrical expert to come down and dislodge the accumulated fluid. The man came and inspected everything. Mr. Brown told about the trouble, and the chief engineer explained it privately to the expert. Finally the electrician assured the distressed proprietor of the yacht that everything had been put right and that he would not be troubled further. Mr. Brown's eccentricities are reported to be approaching a crisis, and it is said that he will soon have to be deprived of what little liberty he has allowed himself by his unusual mode of life.

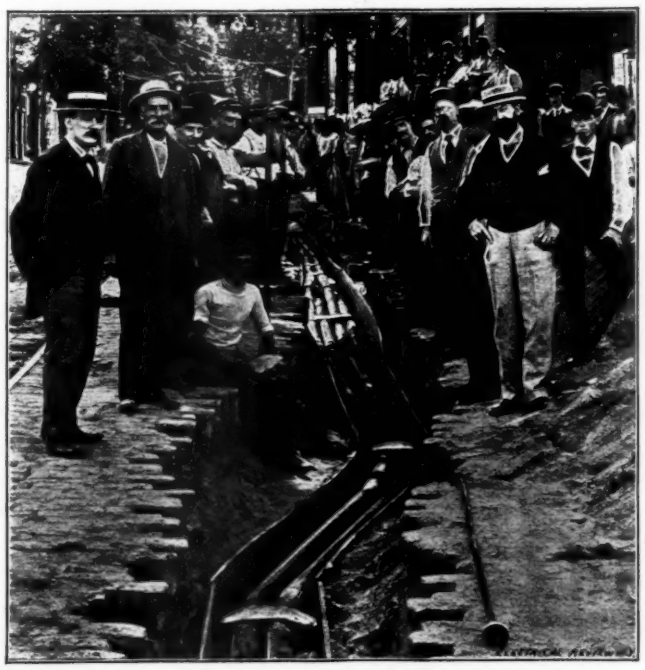
A company engaged in the construction of an electric railway on the Jungfrau proposes to devote $20,000 to the erection of a geophysical observatory at an altitude of about 15,000 feet, and to apply $1,000 a year for its maintenance.

An eminent consulting electrical engineer brought an extraordinary case of the mysterious action of alternating currents before Section G of the British Association. Alternating leads were carried into Mappin and Webb's through separate iron pipes, and the consulting electrical engineers were astounded to find there was a drop. After investigation it was found that the iron pipes had some mysterious action. Another case came to our knowledge some years ago, says the London *Electrical Engineer*. A house was installed with two thick mains with lamps across. The mains were also joined at the far end. It was found that when the dynamo was coupled on there was always a short circuit. After careful investigation by several consulting engineers it was found that when the leads were separated at the far end things went better.

THE NATIONAL CONDUIT MANUFACTURING COMPANY'S SUBWAY SYSTEM.

A DIFFICULT PIECE OF TELEPHONE CONDUIT WORK AT LOWELL, MASS.

The illustration on this page shows a difficult piece of underground conduit work done at Lowell, Mass., for the progressive New England Telephone and Telegraph Company by the National Conduit Manufacturing Company, Times building, New York city. The latter company has laid about 1,500,000 feet of conduit for the telephone company. Over 70,000 feet of this is in Lowell. The illustration shows in a striking manner the flexibility of the system herewith described. A 100 pair telephone cable runs in each duct of the conduit. This subway was started with four conduits, two wide and two deep. Coming to an underground pipe which lay in the way, the subway was spread out to four conduits wide, so as to run over the top of the pipe. This obstruction being passed, the original form of construction was resumed. Proceeding a few feet further rocks were encountered, and as it was cheaper to use a little more conduit than to blast out the rock, the conduit was accordingly turned at a sharp curve, so as to avoid the rock.



A DIFFICULT PIECE OF CONDUIT WORK LAID BY THE NATIONAL CONDUIT MANUFACTURING COMPANY, AT LOWELL, MASS., FOR THE NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY.

The National Conduit Manufacturing Company has been building subways ever since the first experiments were made in underground construction for electrical purposes, and have extensive experience in the drawing in and out of cables, making connection for house and street lighting purposes and distribution of low tension currents. They have constructed subways in almost all the large cities in the United States and Canada, and many of the smaller towns.

The claims made for the National system are, that it is water-tight, gas proof, acid and alkali proof, non-inflammable, a non-conductor, presents a smooth interior, is easily and rapidly laid, and is free from expansion and contraction, joints are perfect, easily and rapidly made in lengths convenient for handling and laying, possesses great strength, is adapted to all places and conditions, is permanent and cheap.

The tubes or conduit consist of a wrought iron shell made of the very toughest wrought iron, thoroughly riveted and lined with five-eighths of an inch of pure cement (no sand or other injurious matter being used), the interior surface of the cement lining being smoothly finished by a special device. The single tubes are made in seven and eight feet lengths and any desired diameter from two inches upwards; each length is provided with ball and socket ends, so as to give greatest facility and certainty of perfect joints and alignment. These tubes are placed in layers in the trench and covered with concrete. The number of tubes or ducts can thus be arranged to meet any requirement. The company has laid them all the way from one single tube in trench to two hundred and twenty.

STREET RAILWAY CONVENTION.

PENNSYLVANIA STREET RAILWAY ASSOCIATION MEETS AT READING.

The third annual meeting of the Pennsylvania Street Railway Association will be held at the Neversink Hotel, Reading, on September 5 and 6, Wednesday and Thursday of this week. The following is the programme:

WEDNESDAY, SEPTEMBER 5.

11 A. M.—Address of welcome in behalf of the City of Reading, by Richmond L. Jones, Esq., Reading.

Meeting of Association.—Annual address of the President, by Hon. Robert E. Wright, of the Allentown and Bethlehem Rapid Transit Company.

Papers.—"The Perfection of Street Railway Motors," by Lincoln Nissley, general manager Citizens' Passenger Railway Company, Harrisburg.

"Power Stations," by L. H. McIntire, general manager Peoples' Traction Company, Philadelphia.

General discussion of subjects upon construction, operation and management of street railways.

Business meeting, 7 P. M.—Complimentary concert to convention at Mineral Springs Park, by the Reading Traction Company.

THURSDAY, SEPTEMBER 6.

10 A. M. to 2 P. M.—Street Railway Supplies Exhibition at Metropolitan Hall, corner Fifth and Chestnut streets.

2 P. M.—Excursion over Mt. Penn Gravity Road, leaving Fifth and Penn streets at 2 P. M.

4 P. M.—Excursion over Neversink Mountain to Klapperthal Park, returning *via* Schulykill river by steamboat.

GENERAL NOTES.

Claymont, Del., is installing a new telephone system.

The long-distance telephone line between Madison and Atlanta, Ga., has been completed.

An electric threshing machine near Lancaster, Pa., cleaned and bagged 200 sheaves of wheat in less than 20 minutes.

The Lorain-Elyria, Ohio, electric road is nearly completed and a big jollification is being arranged by the two towns.

The Chicago Edison company last week bought the plant of the insolvent Co-operative Electric Light Company for $45,000.

The Brush Electric Company is making another effort to get the city of Detroit to buy its machines for the municipal lighting plant.

The Lykens Valley Telephone company has applied for the right of way from Lykens, Williamstown and Tower City, Pa., town councils.

The Cincinnati, Middletown and Dayton, Ohio, Traction Company mean to build an electric railroad between Middletown and Cincinnati. The road, it is expected, will be completed by July, 1895.

Evan B. Stotzenberg has been appointed receiver for the Highland Electric Railway Company, of New Albany, Ind. The road has been running at a loss since it was built in 1891.

A New Electric Locomotive.

The readers of the ELECTRICAL REVIEW will recall an interesting description, published among our articles on the electrical exhibits at the Chicago Exposition, of a 30 ton electric locomotive built by the General Electric Company and exhibited as the first step in advance toward the supersession of the steam locomotive by the electrical locomotive. From 30 tons and one 2-motor truck to 40 tons and two 2-motor trucks is but a step, and the General Electric Company have only recently made it. This 40 ton locomotive is now standing in the factory yard at Lynn and, as will be seen by the illustration, is an imposing looking electrical engine. It is designed to perform the ordinary work of a steam locomotive of similar capacity where excessive speeds are not requisite, up to about 30 miles an hour. It is made up of similar but independent trucks, each having four wheels. Each pair of wheels is driven by its own specially designed motor of the single reduction spur geared type, mounted upon the axle as in ordinary street car practice.

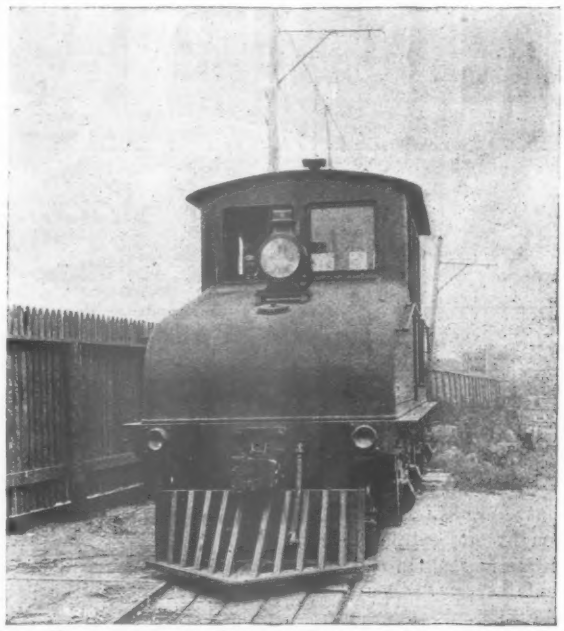


FIG. 1.—FRONT VIEW OF GENERAL ELECTRIC COMPANY'S NEW ELECTRIC LOCOMOTIVE.

The truck frame is constructed of plate iron and channels designed to obtain at the same time both strength and simplicity. The entire weight of the frame including the cab is carried on elliptical springs resting directly on top of the journal boxes. This suspension secures easy riding and minimizes the wear both on the locomotive and the truck.

The journal boxes are of cast-iron with phospher bronze bearings hydraulically pressed in. Lubrication is provided by means of a large well for oil and waste. The journal bearings being outside, all parts are easily accessible for purposes of inspection and repair, and to ensure against any bending caused by hard usage the axle and journals are made large.

The cab rests on the truck in a manner somewhat similar to that in which the ordinary passenger car is mounted, an ample margin for wear and strength being provided. The cab itself is constructed of sheet iron and the windows in it are so arranged as to give an almost unobstructed view from one position in all directions. The design of the cab is such as to give plenty of available floor space without making the top of the cab long enough to obstruct the sight. The design of the cab also makes a symmetrically shaped locomotive.

The electrical equipment comprises, besides the motors, a series parallel controller, an air compressor, which provides the air for the brakes and whistle, and the automatic safety devices. In addition there are bells and headlights and sand boxes.

The dimensions and features of this locomotive are as follows: Weight, 40 tons; draw bar pull, 14,000 pounds; height over all, 11 feet 2 inches; length over draw bars, 24 feet; width over all, 8 feet 4 inches; wheel base of single truck, 6 feet; diameter of drivers with three inch steel tires, 40 inches; number of drivers, 8; size of journals, 4½x8 inches; gauge, 4 feet 8½ inches.

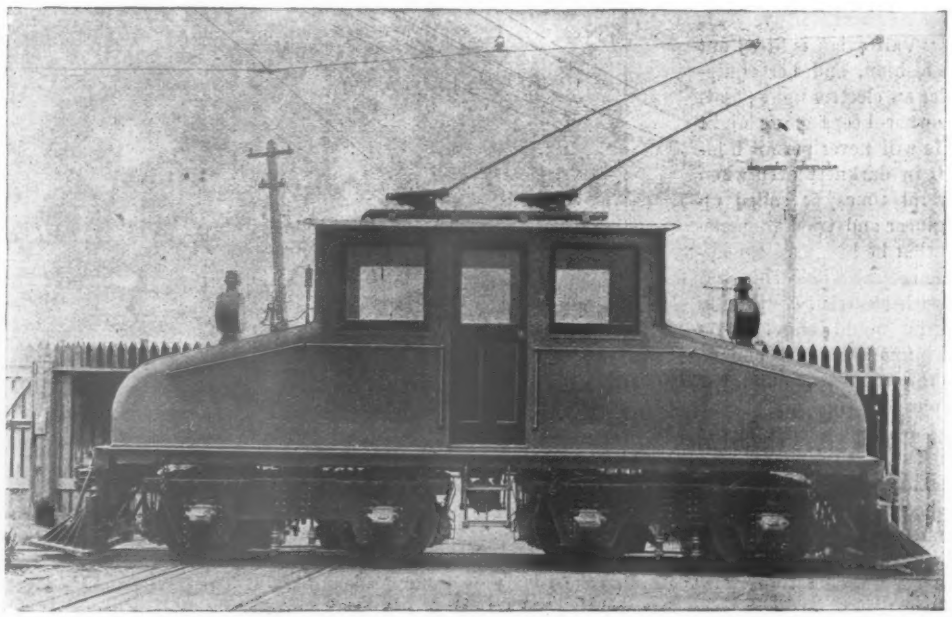


FIG. 2.—SIDE VIEW OF GENERAL ELECTRIC COMPANY'S NEW ELECTRIC LOCOMOTIVE.

La Roche Works Burned.

The five-story building at American and Diamond streets, Philadelphia, owned and occupied by the La Roche Electrical Works, manufacturers of electrical apparatus, was partially destroyed by fire on September 1. Loss $160,000.

H. Ward Leonard & Company in a Receiver's Hands.

Owing to legal complications, H. Ward Leonard & Company, bulk electrical contractors, 136 Liberty street, New York, have gone into a receiver's hands. Mr. Leonard has been appointed temporary receiver.

Curtis Electric Company Shuts Down.

The Curtis Electric Company's works in Jersey City, N. J., have closed down for an indefinite period. This is the third time that the works have been closed and the hands thrown out of work. A fear exists among the men that the shut-down will be permanent. No information concerning the company's intentions can be got at the works, as no one can be seen except the watchman.

The Barrows Electric Railway System.

Mr. Charles H. Barrows, of Willimantic, Conn., is the inventor of the electric railway equipment illustrated on this page. Mr. Barrows' system of elevated and surface railways has already been described in the ELECTRICAL REVIEW. A double truck car, 32 feet over all, is shown in Fig. 1. These cars can be built in lengths to suit, with single or double trucks, and can be used as motor cars, trailers or in trains. All four driving wheels are directly connected in like engagement with the driving pinions on the armature shaft of one motor. The proper tension of the chains is obtained by means of adjustable idler pulleys under the chains and over which the chains run. The application of the power of the motor to the propulsion of the car is by a direct pull on a line from near the periphery of the driving wheels to very near the center of the armature shaft, and is similar to the act of pulling on a rope hand over hand with the rope around the circumference of the wheel to be turned.

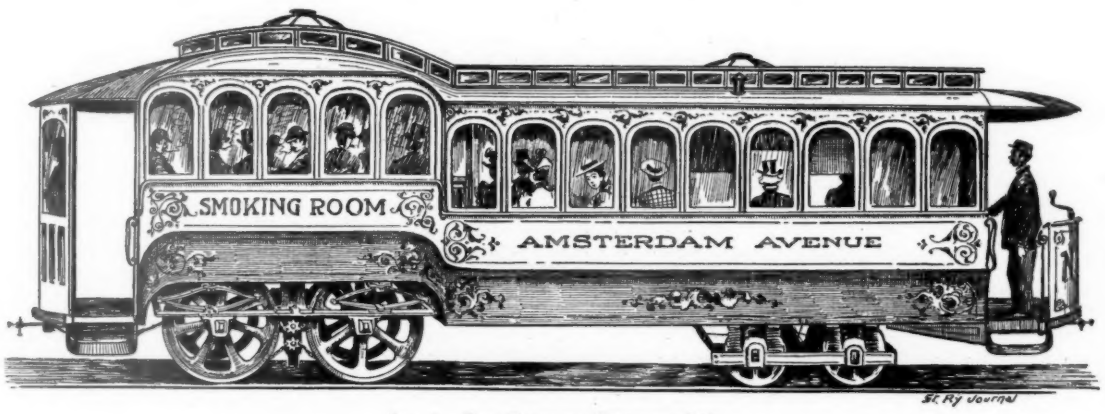


FIG. 1.—THE BARROWS ELECTRIC CAR.

with the motor. As about three-fourths of the total weight rests on these wheels, there is ample tractive force for heavy loads.

In Figs. 2 and 3 the Barrows truck is shown. Its design is novel. The single motor is fixed in the center of the truck, and elastically supported by hangers and bars from the sides and ends of the truck frame, having no contact or connection with the axles, which are entirely free from any friction, except at the boxes, where they are journaled in anti-friction bearings. The motors for these cars are built for high speed, and it is claimed the higher the better, for the greater the number of revolutions the greater will be the leverage for a given speed of the car, and with this sprocket chain driving mechanism, with a sufficient speed of the motor the diameter of the driving pinions might be reduced to simply a couple of spurs on the armature shaft. At each end of the armature shaft is one or more small spur driving pinions engaging with a corresponding number of sprocket driving chains, which pass around drums on the driving wheels. The groove in each drum has an elastic filling, giving a flexible bearing for the chains and increasing the frictional contact between the chains and drums. The sprocket chains are endless and are Thus the power of a fast speed motor is utilized, a point of considerable advantage. Among other advantages of this car are lightness and strength, small friction on curves, owing to the short wheel base, a smoking compartment, ease of starting and stopping and ease of access and egress.

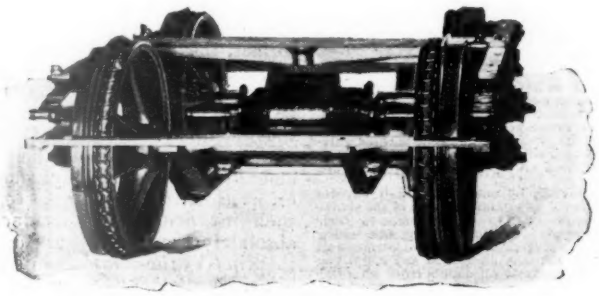


FIG. 2.—END VIEW OF BARROWS ELECTRIC TRUCK.

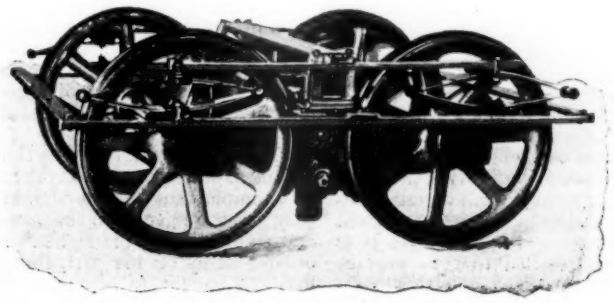


FIG 3.—SIDE VIEW OF BARROWS ELECTRIC TRUCK.

PERSONAL.

Mr. H. C. Whitney, who has been a motor salesman for the Interior Conduit and Insulation Company, of New York, for six months past, has resigned his position.

The numerous friends of Mr. Albert A. Carey, of the Abendroth & Root Manufacturing Company, New York city, will be sorry to learn that he has been seriously ill for the past few weeks with appendicitis, and was recently obliged to undergo an operation. Mr. Carey is at present convalescing and expects to be out in a few days.

Mr. Joseph C. Spaeth, for several years connected with the business office of the ELECTRICAL REVIEW, has organized the Eagle Engraving and Stamping Company, 92 Fulton street, New York. The Eagle company will manufacture medals and ornaments and do all kinds of stamping in gold, silver, bronze, etc. The REVIEW extends its best wishes to the new company.

A Novel Direct Connected Dynamo Set.

A peculiarly novel and simple combination of an engine and electric light dynamo is now in operation at the American Line pier at New York city, says *Cassier's Magazine*. The novelty consists in the fact that when running at any load, under normal conditions, a governor on either the engine or dynamo is entirely dispensed with. The combination consists of a Sturtevant double cylinder engine and a 50 light series arc machine coupled direct to the engine shaft. This novel departure from existing methods is made possible by the peculiar properties and characteristics of the constant current arc machine. As is well known, when a certain number of lamps on a series circuit are supplied by a machine of this type, any addition to, or decrease in, the number of lamps on the circuit will decrease or increase the current supplied by the machine to the circuit, owing to the fact that the more lamps are added to the circuit the higher its resistance becomes. In order, therefore, to keep the current constant it has been the practice to provide upon all arc machines an automatic regulator, which would so operate upon the dynamo, in proportion to the number of lamps that were upon the circuit, that the voltage supplied by the dynamo would vary with the number of lamps upon the circuit—the more lamps, the higher the voltage, each lamp taking about 50 volts. The speed of the dynamo and engine in all such cases is always kept constant by the governor on the engine, and the variable voltage of the dynamo is, therefore, a result of the variation in the strength of the field magnet, or of the different positions of the brushes upon the commutator, or, perhaps, a combination of both.

In the arrangement here spoken of the variable voltage necessary for the variation in load is produced by varying the speed of the machine. As the torque in any dynamo is proportional to the ampere turns in its armature with a constant field, and to the strength of the magnetic field, any variation in the current supplied by the armature will increase or decrease the torque. When lamps are, therefore, added to or taken off the circuit supplied by the machine, the current is proportionally decreased or increased, which correspondingly affects the torque. When a load is added, the current is decreased; this decreases the torque at the shaft of the dynamo, and, therefore, the load on the engine at a certain speed, and the tendency is consequently for the engine to increase its speed until the dynamo has been speeded up to the point where the voltage generated by it will be brought to such a point as to send the same current as before through the higher resistance of the circuit caused by the additional lamps added to it. If lamps be taken from the circuit, or the load be decreased, the current will be increased, and with a certain speed this will increase the load upon the engine. The tendency, therefore, in this instance, would be for the engine to slow down until the voltage of the dynamo had been reduced to where the current sent through the circuit and armature of the machine would return to the same point as under normal conditions and again balance the torque of the engine. In fact, the torque of the engine and the torque of the dynamo always are balanced, and variation in load is made up for by a variation in speed. The dynamo does not alone govern itself as in other cases, but it also actually governs the engine. The normal speed of this engine at full load is about 500 revolutions. As a safeguard against a broken circuit, which would at once throw off all the load, a small governor is used, but it is so set that it begins to act only at about 550 revolutions, or above any speed required even for the maximum load that can be supplied by the dynamo. With such an arrangement of dynamo and engine, it becomes highly important that the boiler pressure should be kept constant, and this would seem to be the principal difficulty to its successful operation. The arrangement would, perhaps, not be applicable in cases where the load upon the dynamo changed very suddenly and greatly, but for many cases it would seem to be feasible, particularly in isolated plants where the steam pressure can be kept fairly constant. It may not be amiss to point out that this method of dynamo regulation is not of recent origin, and is described in Prof. Thompson's book on "Dynamo Electric Machinery."

BRUSH ELECTRIC COMPANY FAILS TO GET AN INJUNCTION AGAINST THE CHLORIDE ACCUMULATOR COMPANY.

JUDGE GREEN'S DECISION IN FULL.

In the United States Circuit Court at Trenton, N. J., on August 27, Judge Green refused to grant a preliminary injunction restraining the Electric Storage Battery Company, of Gloucester city, from infringing patents of the Brush Electric Company in the manufacture of chloride accumulator storage batteries. The opinion is based partly on the doubt that there is infringement. Professors Morton, Chandler, Houston and Doctor Barker testified that there was, and Professors Bracket, Thompson, Cross and Mr. Van Size that there was not.

In view of the conflicting testimony Judge Green decided that further investigation was necessary before the defendants are put to the inconvenience of a preliminary injunction. Another reason for refusing the injunction was that the plaintiffs had not been diligent in asserting and vindicating their rights, the defendants having been permitted to carry on business since 1888. Judge Green's decision in full follows:

UNITED STATES CIRCUIT COURT,

District of New Jersey.

The Brush Electric Company, *et al*,
vs.
The Electric Storage Battery Company, *et al*.

On motion for a preliminary injunction.

Witter & Kenyon for complainant.
John R. Bennett for defendant.

Green, J.

Two reasons conjointly compel a denial of the motion for a preliminary injunction made by the complainants.

The validity of the letters patent in question is beyond dispute. They have been sustained by all the courts before which they have been the subject of litigation. The only question to be considered upon this motion, under the circumstances, is that of infringement. While it is well settled that a preliminary injunction will issue almost as a matter of course in any given case wherein the defendants are shown to be guilty of infringement, after an adjudication establishing the validity of the letters patent involved in the litigation, yet it is equally well settled that to warrant and justify the exercise of this extraordinary power the proof of the alleged infringement must be clear and decisive. Equity peremptorily insists that such action so drastic in its effects shall be taken only in those cases wherein a clear, unclouded, equitable right to the interference of the court is shown; in all other cases the demand is to be met by a refusal. Otherwise unfair prejudgment may result.

In the case at bar the proof of infringement fails to attain to this standard. It is quite true that, on the part of the complainants, certain gentlemen, most eminent in their profession, and whose opinions as experts are entitled to great weight, have not hesitated in their affidavits, presented to the court upon this motion, to assert quite positively that not only the storage battery manufactured by the defendants, but as well the process used in the manufacture, do, without doubt, infringe some, if not almost all, of the claims of the letters patent under consideration; and they laboriously strove to justify the opinions so expressed—first, by giving to the letters patent and the various claims an exceedingly broad construction; and, secondly, by basing such broad construction upon a yet broader construction of the legal conclusions of the learned judges who have in past litigations defined and characterized the inventions of Faure and Brush.

Giving full weight to the opinions of these witnesses, elucidated and most eloquently enforced upon the attention of the court in the exceedingly able argument of counsel, it still remains to be said that the defendants have, in opposition thereto, presented opinions of other scientists, equally as learned and of equal standing and repute in the scientific world, which are directly antagonistic thereto, and by which they most distinctly and positively declare that in their judgment neither the process pursued by the defendants nor the completely manufactured battery impinges in the slightest particular upon those secured to the complainants by their letters patent. And so upon the one side are found the concurring opinions of Professor Morton and Professor Chandler, Professor Houston and Doctor Barker; upon the other those of Professor Brackett, Professor Cross, Professor Thomson and Mr. Van Size. These are gentlemen of unquestioned veracity, thoroughly understanding the subject matter under consideration, stating opinions with confidence which they believe to be well formed, and yet they arrive at conclusions which are irreconcilably and diametrically opposed. It must be apparent that affidavits of this character, *ex parte* as they are, can only be productive of doubt. When the statements so made and the opinions so expressed come to be tested by a severe and thorough cross-examination, beyond question, those which show themselves securely founded upon reason and fact will be immediately accepted and concurred in; but until then the existence of a doubt, well founded and reasonable as to the right of the complainants to the remedy they ask, cannot be overlooked. The existence of such doubt must, now at least, control the action of the court. It is fatal to a motion for a preliminary injunction to justify the interference of a court of equity, *pendente lite*, by way of an injunction. The actual or threatened infringement of a right must appear as clear as the noon-day sun.

There is another reason why this motion must be denied. Equity demands of a complainant that he should display great diligence in the assertion and vindication of his rights. Inexcusable delay on his part, though it may not amount to conclusive proof of acquiescence, nevertheless, maybe and often is sufficient cause to disentitle him to the summary interference of the court on his behalf by way of interlocutory injunction. Whatever may be the original equities of the case, as between the parties, if the complainant stands quietly by without seeking to enforce his rights, while the defendant expends time and labor and money upon the enterprise sought to be enjoined upon faith that no actual or effective objection thereto will be made, he will be shorn of any right to appeal to the Court of Equity for assistance. Hummer vs. Hummer, 2 Green (Ch.) 263; Whitney vs. Union 6, 11 Grey, 359; Carlisle vs. Cooper, 21 N. J. Equity 599.

In other words, the principle has been thus stated: No one can have relief if his own conduct has led to that state of affairs which occasions the application.

The proofs submitted to the court on this motion show these facts. The defendant corporation was organized under the laws of the State of New Jersey in 1888. Its sole purpose was to engage in the manufacture and sale of electric storage batteries, of the type known as the Chloride Accumulator. Its works were located at Gloucester in this State; and from the time of its incorporation to the present, it has carried on its business without interruption. Its existence and the character and extent of its operations were well known to the principal officers and managers of the complainant corporation. In the conduct of its business at various times and especially in 1891, 1892 and 1893, the defendant openly installed storage battery plants of the alleged infringing type in various public buildings and for various corporations. Thus, for example, they furnished plants or batteries to the Provident Insurance Company, of Philadelphia; to the Metropolitan Railway Company, of Washington; to the Union Square Theater in New York, and elsewhere. The fact that these plants were furnished by the defendants was well known to the complainants. Besides, early in 1893 the defendants issued a pamphlet in which was printed an opinion of Professor Chandler, of Columbia College, on storage batteries, and which contained a detailed and correct statement of the mode of construction and operation of the storage batteries of the defendants, and a full and succinct comparison between them and the batteries of the complainants. This pamphlet was widely circulated, and admittedly the complainants knew of it. In July, 1893, the defendants, through its president, sent to the complainant corporation a letter in which, among other things, is the following statement and appeal:

"PHILADELPHIA, PA., July 27, 1893.

"MR. WILLIAM BRACKEN, *President Consolidated Electric Storage Company, New York, N. Y.*

"DEAR SIR—I am favored with copies of your letters of 27th of February and the 24th of July, 1893, to Mr. George W. Pearson, president of the Metropolitan Railway Company, of Washington, D. C., wherein you state that the battery manufactured by the Electric Storage Battery Company, of Philadelphia, is a clear infringement of the Brush patents, and of which 'there is no earthly doubt.'

* * * * *

"By what authority do you say our battery infringes the claims of your Brush patent? Surely on the authority of no court, for you well know that no court has declared our battery to be an infringement, and although we have been to your knowledge openly engaged in manufacturing our batteries for some years, you have not down to this moment proceeded against us, although threatening to do so for nearly eight months past. You apparently propose to dispose of our battery and business without even resorting to the courts wherein such questions are usually determined.

* * * * *

"Unlike you, we have sufficient confidence in our position to submit the question to the courts empowered to consider and determine such questions, and there we invite you to meet us at once, and unless you do so, or discontinue your libelous statements against our battery, we will take such steps as we are advised are open to us to protect our interests.

"We are advised by our counsel and experts that our battery does not infringe any of the claims of your patents, and having confidence in their opinion we propose to continue making and selling our battery, and shall protect and save harmless all users of them, not only as against any claim you may make, but against all claims from whatever source.

"Now, being advised of our intentions, we demand, in view of statements made in your letter to Mr. Pearson and other parties, that you proceed at once against us on a bill of infringement accompanied with motion of injunction so that the question of our infringement of your patents may be determined, and to that end we advise you, viz:

"We are a New Jersey corporation with a factory at Gloucester, in that State, where batteries are being manufactured daily, and we will at any time furnish you with one of our batteries, at the usual price, accompanying same with a sworn statement of precisely how they are made with permission to use the same in any proceedings against us.

"We have, to avoid delay, authorized our counsel, Mr. John R. Bennett, Potter Building, New York city, to accept service papers in our name and to aid you in every way possible to reach the courts at the earliest possible moment, and you can arrange with him, either direct or throughy our counsel, for one of our batteries and a statement of its construction.

"If you have confidence in your position you will, of course, accept our most reasonable proposition to proceed against us at once, and if you do not we hereby notify you that we shall proceed against you, to protect our interests, holding you responsible for the damage resulting to our business by the making of statements and the sending out of such unfounded libelous letters as you have sent to Mr. Pearson."

To this letter the complainants returned no answer beyond a mere acknowledgment of receipt, and admittedly took no action toward the assertion of their claim until months after.

In the meantime the defendant, assuming, as it cannot be denied they had reason to do, that no attack was to be made upon them, increased their capital stock $250,000 and proceeded to erect in addition to their existing factories a very extensive plant at a very large cost. It was not until 1894, months afterward, that this bill of complaint was filed. Realizing the necessity of making explanation of their delay the complainants allege that it was caused first by their diligent searching for some purchaser of the defendant's storage battery within the jurisdictional limits of the Circuit Court of the United States for the District of Southern New York, in which forum much of the previous litigation concerning the Brush and Faure batteries had taken place, and so avoid by the bringing of their suit in that jurisdiction some of the trouble and labor which would necessarily follow the commencement of a suit in this jurisdiction; and, further, that all the operations of the defendants were considered by the complainants to be simply tentative in the line of producing a practical commercial storage battery, and only an effort on the part of the defendants to persuade the complainants to spend thousands of dollars in substantially a moot litigation to stop the making and sale or use of only a few batteries, and because the complainants believed the venture of the defendants was destined to be a failure and die a natural death.

It is hardly necessary to say that such excuses do not justify the laches of which the complainants have been clearly guilty. If the rights of the complainants are now trespassed upon by the defendants, they were in like manner trespassed upon more than four years ago, and the trespass, of which so loud complaint is made now, has been continuous. For reasons satisfactory to themselves the complainants, well aware of these continuous trespasses, chose to stand by without taking action looking to the vindication of their rights and the prompt punishment of the trespasser. The result of such inaction on the part of the complainant is found in the increased contribution to the capital stock of the defendant corporation of hundreds of thousands of dollars and the expenditure of an exceedingly large amount of money in the erection of greatly extended plant. If, in fact, the rights of the complainants have been invaded by the alleged infringing acts of the defendants, it is scarcely an exaggeration to say that the dilatory conduct of the complainants in protecting their rights amounted to open encouragement of, or, at least, to silent acquiescence in, such invasion. Such conduct bars absolutely the remedy asked for at this time by the complainants. Brisbin v. Burdick, 12 Beavan, 1; Smith v. S. W. Railway Co., Kay 417.

It was admitted upon the argument that the defendants were financially responsible and amply able to respond to any award of damages that might be made against them. Under all the circumstances and for the reasons given the motion for a preliminary injunction is denied.

Interested in Electrical Development.

[*Howard in the N. Y. Recorder.*]

"Yet at it. I see by the ELECTRICAL REVIEW that our venerable friend, the Hon. John C. Wyman, of Providence, at a recent Rhode Island clambake, spoke of the development of electricity 'in his customary eloquent and humorous vein.' Dear old boy! A half century of that sort of thing has neither staled him nor tired his friends."

MONTMORENCY FALLS AND ELECTRICITY.

AN INTERESTING ELECTRICAL PLANT FROM THE STANLEY COMPANY TO BE INSTALLED BY THE MONTMORENCY POWER COMPANY, OF QUEBEC.

The Stanley Electric Manufacturing Company, of Pittsfield, Mass., recently made an important contract with the Montmorency Electric Power Company, Quebec. As the details of the contract are of considerable interest, the ELECTRICAL REVIEW presents them somewhat in full.

There were ordered three 675 horse-power two phase alternating current generators, to be used in conveying the water-power of the beautiful Montmorency Falls to the city of Quebec for lighting and power purposes, a distance of eight miles. This makes a combination of the beautiful, the scientific and the practical at once interesting and progressive. The falls altogether are over 300 feet, one perpendicular fall being 268 feet. For 10 years past this water-power has been supplying light in Quebec, the present plant consisting of three 2,000 light alternating current machines made by the Royal Electric Company, Montreal, and 15 arc light machines with a total capacity of 600 lamps. The present machines are single phase and give 1,800 volts at the falls and deliver 1,000 volts at Quebec, supplying ordinary lighting service only. The Montmorency company decided a short time ago to put in a thoroughly modern plant. The three large machines which they bought of the Stanley company will generate a potential of 5,500 volts; the output of each machine will be carried on four wires to a sub-station in Quebec where step-down transformers will reduce it to 2,000 volts and the distributing system through the town will be at this potential. They are furnishing 1,000 kilowatts capacity of step-down transformers for this purpose, which will be placed in a sub-station built purposely for their reception, with very complete arrangements for keeping the transformers cool by air blasts. The current will be used for lighting, general power distribution by two phase alternating current motors and for running street railways by use of rotating transformers. In the sub-stations there will also be a very complete switchboard installation. There will be one switchboard for the railway service, one for the arc light service and one for the two phase light and power service. The offices of the company will also be in the same building. The drop in the line between the falls and the sub-station will be 6 per cent.

The Montmorency company, under the able general management of Mr. F. H. Badger, has taken a most progressive step, and the results of this move are sure to meet with the highest success. Mr. Badger is a son of the city electrician of Montreal; was formerly with the Royal Electric Company, of that city, and has been with the Montmorency company since February 1, 1894, and is recognized as a capable and progressive electrical engineer. The advanced manufacturing work of the Stanley company, which is ably managed by Mr. Henry Hine, and the thoroughness of everything done by Mr. Badger, assures as complete a plant, when finished, as may be found in this country.

The MacCormack Water Tube Boiler.

Mr. John MacCormack, of 126 Liberty street, New York, is the patentee of the improved water tube boiler illustrated herewith. The scientific principle of the boiler has already been tried most successfully, but only in the most complicated mechanical form. The inventor has obviated that condition, having found by experiments and years of experience that simplicity of construction is always more satisfactory. The boiler consists of two water heads, one steam shell and flues under and alongside the shell, set on brick work and supported by properly constructed boiler lugs, with the necessary manholes to repair, clean and inspect all flues without disturbing the boiler proper.

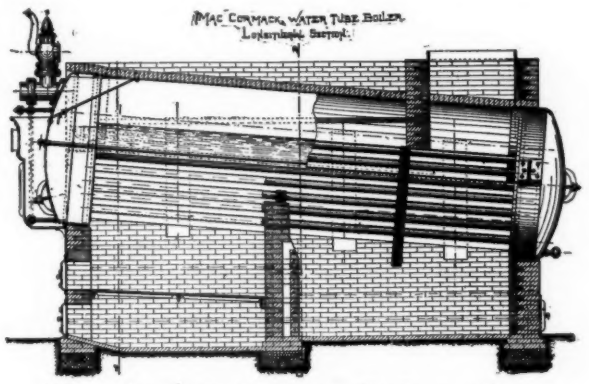


FIG. 1.—LONGITUDINAL SECTION OF MACCORMACK BOILER.

Internally the boiler has a dry pan, so constructed that it acts both as dry pan and deflecting plate. It is fed from the front head through a pipe which extends along within five feet of the rear water head, and three inches from the bottom of the steam shell. The blow off is at the bottom of the rear water head. The two water heads of the boiler are made of sufficiently strong material to withstand the high pressure now used. The shell is connected to the water heads. This arrangement gives strength and facilitates circulation. The tubes are entered into flue sheets, expanded in the sheets in the usual manner, and each tube is bell-mouthed inside of each flue sheet, thereby giving additional strength, so that, considering the thickness of material used, together with the expanding and bell-mouthing of flues, the use of stay bolts or braces can be dispensed with. There are sufficient manhole plates in each head, so that the tubes can be examined, cleaned and repaired. All tubes can be taken out and replaced with dispatch, which will be seen on examination of the drawings. No cast-iron is employed anywhere. It is a simple boiler to manufacture, and has no experimental features.

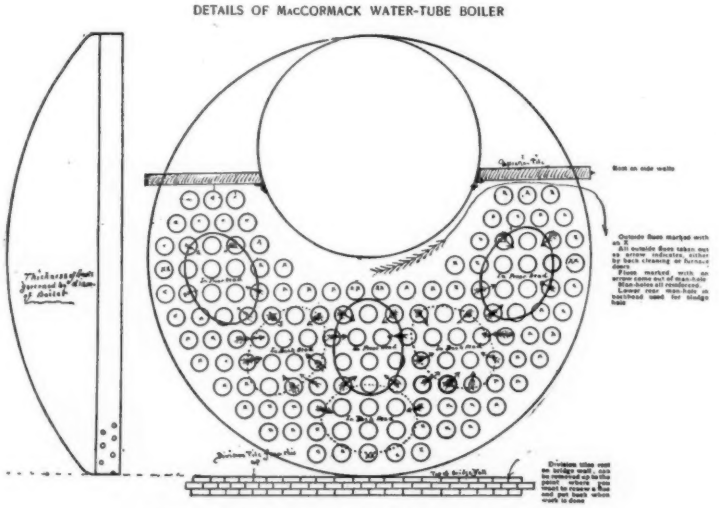


FIG. 2.—CROSS SECTION OF MACCORMACK BOILER.

Brooklyn Electrical Society.

The Brooklyn, N. Y., Electrical Society has begun its second year of existence. An interesting programme of lectures has been prepared for the Winter season. The future meetings are to be held at the Edison Electric Illuminating Company's central station, on Pearl street, near Myrtle avenue. Manager W. B. Barstow is actively interested in the society. At the recent annual meeting the following officers were elected: William Clinton Burling, president; William C. Otten, vice-president; Arthur A. Fisk, secretary; Thomas A. Bamford, treasurer. Mr. Bamford is chairman of the Membership Committee, and all communications bearing on membership should be addressed to him at No. 259 Eleventh street.

Gas Lighting for Electric Street Railway Cars.

TO THE EDITOR OF ELECTRICAL REVIEW:

We notice in your issue of August 29 the communication from "Engineer" relating to lighting by gas the cars of the Columbus Central Railway Company, and as we have charge of the construction and equipment of that railway we are impelled to reply and give some reasons for what might be considered a step backward.

We have adopted the Pintsch gas system of lighting for two very simple reasons—first, because we believe it will afford better satisfaction to passengers than the electric light; and, second, because in the long run it is calculated to be more satisfactory to the railway company.

"Engineer" comes very near stating the various factors which have led us to the conclusion, which we have long since reached, that electric lighting from the trolley wire is not the thing. Everyone has observed how disagreeably the incandescent lamps in a motor car vary. There are few roads where the circumstances permit such perfection of distribution that the potential remains constant. The lights will vary continually. They go out every time the trolley leaves the wire. They go out when a single filament happens to give way. They blacken and become dim with age. The frequent recurrence of darkness is an annoyance to those who wish to read, and a source of much fright and nervousness to female passengers. These troubles are inevitable with electric lighting in the cars.

Gas, however, lends itself admirably to the general comfort and convenience. No matter what the condition of the wires, generators, engines or boilers, the *light* remains. In any one of the numerous accidents which deprive the line of its current, the car is not affected in its illumination, and, of course, this is true whether the stoppage of current is momentary or prolonged. Gas lighting puts no additional burden on car-house men further than once every day to connect the charging hose to the valve on each car for a few seconds. The tanks are concealed from view; there is no offensive leakage, and all will admit that the illumination is all that can be desired, strong and perfectly uniform.

In all this we, of course, do not mean to cast any reflection on electric lighting for all the usual purposes. That were, indeed, a step backward. We simply believe that in railway motor cars the operating current is not adapted to give the best illumination. The days of oil are gone by. Storage batteries do not fill the bill, and gas is not only the one thing left, but in our judgment is the best of all for the purpose.

A little later on we shall take pleasure in giving you further particulars.

BARRY & MCTIGHE,
Electrical Engineers.

New York, Aug. 30, 1894.

The Albany, N. Y., *Argus* predicts that within six years the death-knell of steam as a motive power will be sounded.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 2339. NEW YORK.

EDITOR:
CHARLES W. PRICE.
ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.
1546 "CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.
WASHINGTON OFFICE:
GEO. C. MAYNARD, 800 H St., N. W.

ADVERTISING DEPARTMENT,
H. T. RICHARDS, Manager.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10
Back Copies, each, - - - - - - .25

NEW YORK, SEPT. 5, 1894.

CONTENTS.

	PAGE
Views, News and Interviews	109
The National Conduit Manufacturing Company's Subway System	109
Street Railway Convention	110
General Notes	110
A New Electric Locomotive	110
La Roche Works Burned	110
H. Ward Leonard & Company in a Receiver's Hands	110
Curtis Electric Company Shuts Down	110
The Barrows Electric Railway System	111
Personal	111
A Novel Direct Connected Dynamo Set	111
Brush Electric Company Fails to Get an Injunction Against the Chloride Accumulator Company	112
Interested in Electrical Development	112
Montmorency Falls and Electricity	113
The MacCormack Water Tube Boiler	113
Brooklyn Electrical Society	113
Gas Lighting for Electric Street Railway Cars	113
About Smoke and Some Other Things	114
Electric Railway Notes	115
A Few of the Wonders of Electricity	115
Completing the Mackay-Bennett Cable	115
What Paper Is Made Of	115
Lightning Made Him a Colored Man	115
Advertising in the ELECTRICAL REVIEW Pays	115
Specifications for Vestibuled Electric Railway Trains	115
Opening of the New Netherland	115
It Will Rain if the Dynamos Stop	115
The Rise of Electricity	116
Primary Battery Testing	117
Electric Light Flashes	118
Walter K. Freeman in Trouble	118
Obituary	118
The Hubley Trolley Harp and Wheel	118
Telephone News and Comment	118
Chloride Accumulators in Birmingham, England	119
The Street Car Service of Terre Haute, Ind	119
Metallic Circuits—That's the Answer	119
Street Railways	119
Kindred Interests	120
Electrical Patents	x
Advance Information	x

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
Ansonia Brass & Copper Co., wire	xvi
Armington & Sims, engines	xvi
Beacon Vacuum Pump and Electrical Co., incandescent lamps	i
Bristol Co., The, recording voltmeters and pressure gauges	i
Bunnell & Co., J. H., dry batteries	i
Campbell Electrical Supply Co., insulating tape	i
Day's Kerite, insulated wire	i
Eastern Electric Cable Co., insulated wire	xvi
Electric Construction and Supply Co., arc lamps	ii
Eddy Electric Mfg. Co., motors	i
Fort Wayne Electric Corporation, slow-speed iron-clad alternators	ii
Globe Iron Roofing and Corrugating Co	i
Goubert Manufacturing Co., heaters	xvi
Hampson & Co., E. P., engines	xvi
Hammond Cleat and Insulator Co., wall receptacls	i
McKenney & Waterbury, lamps and fixtures	i
National India Rubber Co., wires and cables	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Company, motor and generator brushes	i
Rhode Island Tool Co., tools	xvi
The Stirling Co., safety boilers	xvi
Weston Engine Co., engines	i

INSIDE PAGES.

American Bell Telephone Co	iv
American Carbon Co., carbons	viii
American Watch Tool Co., bench lathes	xiv
Ashcroft Mfg. Co., gauges	xiv
Baker & Co., platinum	120
Berlin Iron Bridge Co., iron roofs and buildings	xiii
Billings & Spencer Co., commutator bars	xiv
Bishop Gutta Percha Co., wire	xii
Bolgiano Water Motor Co., fan motors	x
Bradbury-Stone Battery Co	x
Buffalo Engineering Co	xiv
Brixey, W. R., wire and cables	v
Brown & Sharpe Mfg. Co., machinery and tools	xiv
Brush Electric Co., arc lamps	vi
Bryant Electric Co., electrical specialties	xiv
Buckeye Electric Co., incandescent lamps	viii
Buckeye Engine Co., engines	xi
Case, J. T., Engine Co., engines	vi
Central Electric Co., electrical supplies	iii
Chapin, Chas. E., R. Thomas & Sons, porcelain	xiv
Clark Electric Co., arc lighting	iv
Clonbrock Steam Boiler Works, steam generators	iv
Connecticut Pipe Mfg. Co., cement lined ducts	xi
Consolidated Electric Storage Co., batteries	vi
Correspondence School of Sciences	120
Correspondence School of Technology	x
Cutter Electrical and Mfg. Co	xiv
Davis, Lewis K., consulting engineer	xiv
Dixon, Jos., Crucible Co., belt dressing	iv
Edson, Jarvis B., recording gauges	ix
Electrical and Mechanical Engineering and Trading Co	vi
Electric Storage Battery Co., chloride accumulators	vii
Empire China Works, porcelain specialties	iv
Falls Rivet & Machine Co., friction clutches	xii
Faraday Carbon Co., carbons	xi
Faries Manufacturing Co., electric light holder	x
Garvin Machine Co., machine tools	iii
General Electric Co., Thomson 93 arc lamp	ix
General Electric Launch Co., electric launches	120
Harrisburg Foundry & Machine Works, engines	vi
Harrison International Telephone Co., telephones	iv
Hart & Hegeman Mfg. Co., snap switches	xiv
Helios Electric Co., arc lamps	xiv
Hornberger Electric Co., Elkhart transformers	vi
Huebel & Manger, bells, push buttons, etc.	xiv
Hulbert Fence and Wire Co	vi
Interior Conduit and Insulation Co., Lundell dynamos and motors	xiv
Keasbey & Mattison Co., magnesia sectional coverings	119
La Roche Electrical Works, generators and motors	xiv
Lancaster, Sam. C	xii
Leclanché Battery Co., batteries	xiv
Lehigh Valley Creosoting Co., creosoted lumber	120
Leonard & Co., H. Ward, contractors	120
Livgro Incandescent Lamp Co., incandescent lamps	iii
Manning, Maxwell & Moore, tools and supplies	xiv
Marshall, Wm., condensers	120
Moore, Alfred F., wire	ix
Mutual Life Insurance Co	vi
National Conduit Mfg. Co., tubes for electric subways	xi
National Pipe Bending Co., feed-water heater	ix
National Telephone Mfg. Co., "The National."	iii
New England Engineering Co	iii
New York Belting and Packing Co., rubber belts	iv
New York & New England R. R	120
New York & Ohio Co., Packard lamps	viii
Novelty Electric Co., electric supplies	xiv
Ostrander & Co., W. R., supplies	vi
Oxford Mfg. Co	120
Palmer Bros., telephones	120
Perkins Electric Switch Mfg. Co., switches and sockets	xiv
Perkins, H. H., annunciator	xii
Phillips Insulated Wire Co., wire	viii
Riker Electric Motor Co	xiv
Robinson & Orr, steel rails	120
Rosenbaum, Wm. A., electrical expert and solicitor of patents	xiv
Royce & Marean, electrical supplies	120
Schieren & Co., Chas. A., leather belting	120
Schoonmaker, A. O., India mica	xiv
Self-Winding Clock Co., clocks	xiv
Siemens & Halske Electric Co., dynamos and generators	xiii
Smith, Jas., Woolen Machinery Co	xiv
Solar Carbon and Mfg. Co., carbon specialties	xiv
Splitdorf, C. F., electro-magnets	xii
Standard Paint Co., insulating compounds	viii
Thompson & Bushnell Co	xiv
Warfield, L., Detroit, railway motors	viii
Western Electric Co., supplies	iv
Western Telephone Construction Co., telephones	iv
Westinghouse Electric & Manufacturing Co., multiphase motors and generators	xi
Weston Electrical Instrument Co., measuring instruments	viii
White-Crosby & Co., contracting engineers	120
Williamsport Wooden Pipe Co., creosoted conduits	xiv
Wyckoff Pipe Co., inc., creosoted tubing	120

The beautiful falls of Montmorency, near Quebec, are soon to be devoted to the most advanced ideas in transmitting electricity for power and light. Thus does the beautiful in science and nature lend itself to the comfort and benefit of man.

ABOUT SMOKE AND SOME OTHER THINGS.

The New York city daily papers have very properly been calling attention to the smoke nuisance. The New York Steam Heating Company, which was forced to change from soft to hard coal about a year ago, was not the only offender. The time will come when fires of any kind belching foul gases into and polluting the air will not be tolerated within city limits. It is safe to say that when such a municipal regulation is inaugurated it will have an enormous influence on the public health. So far as concerns an effective means of displacing the fires, it has long been at hand and could indeed be made to compete if not outrival in cost to the individual consumer the present method of making and using heat. At present we have thousands of chimneys spouting volumes of soot and nocuous gases in every city; not only are they offensive to the senses, but if the matter be considered a moment it will be realized that they are really more expensive than a perfectly pure agent to effect the same result would be. What an enormous waste of fuel there is in the domestic—by which we mean the family—use of fuel. The fire rages all day, Summer and Winter, because, forsooth, it is impossible or impracticable, or at all events certainly very inconvenient, to keep it going in any other way; the economical management of a fire is a fine art in which but few are skilled.

What a waste also in the numerous factories which are the mainspring of municipal progress. All this could be greatly mitigated, and a clean and wholesome substitute furnished without increase of expense, and we are talking advisedly and not through our hat when we say so.

An electric current of sufficient volume to supply all the needs of a whole city, manufacturing and domestic, can be manufactured, so to speak, without the city limits and distributed at a price which would net the consumer a lower cash outlay than he now disburses to the coal barons. Light, heat, power, locomotion, all ubiquitous and universal within city limits. This millennium is not far off. It wants only municipal organization and a city ordinance or two. The smoke nuisance will then disappear forever from sight and smell, and steam locomotives entering a city become a thing of the past. Great social changes are sure to follow in the wake of such a revolution. The mechanic will have a show for individual effort; a strong reaction will set in against the prevailing modern tendency to aggregate large bodies of men under one management.

A spirit of contentment will gradually leaven the spots where nihilists and other microbes now wax fat; the laborer may then become his own master in many of the industrial arts and the troublesome wage question will be relegated to innocuous desuetude among the things that were. How enormously would such an equipment promote our general creature comforts. Always at hand in the chill of Winter, a source of heat that will be, not in name, but in fact, self-regulating; a source of light always with us in any part of the domestic labyrinth—minus a preliminary ghostly chase after a match; a range that can be economically run by one with even less wit than Chloe; an automatically operated fan to temper Old General Humidity; a lift on the elevated to which our legs, shaky with the present long flights, will lustily cry more. It is, indeed, difficult to define a want that may not be readily filled with an adequate source of heat, light and power, such as is easily and feasibly within our reach.

Let us mould public opinion to a decree against smoke, and the rest will come; then will the millennium be at hand.

We are willing to sacrifice something for the sake of being on hand.

An excellent pointer on the revival of business is given by Joseph Howard, Jr., in the N. Y. *Recorder*, in which he says: "No better evidence of returning prosperity, now that the cuckoos have homeward flown, can be asked than the fact that mercantile telegraphy has noticeably increased within the past three weeks, when the tariff bill became a certainty, and subsequently when Congress adjourned. I understand that the volume of business handled by the Western Union is at least 20 per cent greater than in the preceeding months."

In our last issue we published a communication from "Engineer" on the adoption of gas for lighting motor cars, and we now print an explanation by the engineers who have taken this somewhat bold step. We prefer to suspend judgment ourselves till we know more about the facts and results of gas lighting, from both the physical and commercial standpoint. It is a subject of considerable importance to the electric railway interests of the country and will bear very close attention.

If the elevated roads of New York are not far-seeing enough to adopt electric power, it would be money in their treasury to put in electric elevators at every station. This could be done at small expense and the returns would be large and immediate.

ELECTRIC RAILWAY NOTES.

Mahanoy City, Pa., wants an electric line built to Delano.

An electric railway is wanted between Mt. Sterling and Clay City, Ky.

A scheme is on foot to connect Doylestown with Newtown, Pa., by trolley.

An electric railroad from Ashfield to Shelburne Falls, Mass., is being talked of.

The Mt. Carmel and Shamokin, Pa., Electric Railway was put in operation for the first time on Labor Day.

A Pittsburg trolley company will extend its lines to Glenshaw, Pa., if the citizens of that place will put up $5,000.

The sale of the Attleboro, North Attleboro and Wrentham, Mass., Street Railway has now been set down for September 4.

The Hartford, Conn., Councilmen have passed resolutions requiring all street cars to be equipped with satisfactory safety fenders.

Baltimore and Gettysburg will soon be connected by an electric road 50 miles long, 22 miles shorter than by the present railroad route.

The Rutland, Vt., Street Railway Company has made a contract with the Rutland E'ectric Light Company to furnish power to run its electric cars.

The West End Street Railway Company, of Boston, will erect a $20,000, 223x87 feet car house on Sewall place, Brookline, and will expend about $10,000 in doubling the size of its reservoir car house.

Contractors have signed a contract with the Lowell, Lawrence and Haverhill, Mass., Street Railway Company, which calls for the completion of an electric road from Lawrence to Lowell within 60 days. Work has been begun.

The electric railway between Bethlehem and Allentown, Pa., has become such a serious competitor of the Lehigh Valley Railroad, that the latter is attempting to bankrupt it by putting down round trip fares to five cents. The distance is 14 miles both ways.

Long Island Traction Company books close September 15 to allow stockholders the right to subscribe pro rata for $2,500,000 six per cent collateral trust notes of the Long Island Traction and Brooklyn Heights, N. Y., Railroad Company, at 85 per cent of their par.

John E. Kraft, of Kingston, N.Y., and Arthur Walradt, of New York, have been appointed receivers of the Colonial Electric Railway Company by Judge Parker. The Colonial Electric Railway is one of the projects of Goodwin & Swift, of New York city, who recently made an assignment to Mr. Walradt.

The Brockton, Mass., Street Railway Company has been advised to overflow Norroway Lake, otherwise known as Clark's meadows, to its full extent the coming Fall, and advertise it as a skating rink. It is on the line of the railway and would doubtless prove a paying attraction for the Winter season.

The Market Street, Richmond and Frankford Elevated Electric Railroad has filed a bond of $1,000,000 with the Philadelphia City Solicitor after obtaining an ordinance of Councils to construct an elevated road on certain streets. Operations will begin as soon as the plans are approved by a committee of the Board of Highway Supervisors.

Considerable progress is being made with the Nassau Electric Railway, of Brooklyn, N. Y. Building operations were begun about May 1, since which time work has gone on continuously, giving employment to several hundred men. When completed the road will give the longest ride for five cents of any road in the country. President Flynn says that cars will be running from Broadway to Canarsie through Rockaway avenue in two weeks.

The increase in the gross earnings of the West End Street Railway Company, of Boston, for August is at the rate of about $20,000 per month. The company is now more conservative in its charges to construction, and puts into expense considerable that would formerly have been charged to construction. The company has five years in which to put its feed wires east of Dover street under ground, and will do one-fifth of the work this Fall.

The directors of the Hartford, Manchester and Rockville, Conn., Tramway Company met in Hartford last week, when it was expected that the contract for constructing the line would be awarded, but the matter was referred to M. S. Chapman, R. S. Hicks and H. J. Wickham as a committee. Nine bids to construct the road have been made, some of which are very close, and the committee now knows just about where it stands in the matter of awarding the contract. This same committee was authorized to get bids for rolling stock for the line. The company has filed in the State secretary's office a certificate of acceptance of charter.

A Few of the Wonders of Electricity.

We are apprised that we can cook by electricity, we run boats and trains and carriages and bicycles by electricity, we light our streets and halls and theaters and even our stomachs by electricity, we fire broadsides on our cruisers by electricity, we do away with the impecunious free lunches by fastening a battery to the bar rail and pulling the stopper out, we use the same current to strengthen nerves that is employed to burn out a tumor or kill a New York thug, we can sit in our parlors, pretty soon, and turn knobs that will enable us to see and hear prize fights and plays and operas and naval reviews and what our friends are busy at in China and Australia. Yes, a great force is electricity.—*Brooklyn, N. Y., Eagle.*

Completing the Mackay-Bennett Cable.

The steamship "Mackay-Bennett," of the Commercial Cable Company, arrived in New York harbor last Wednesday and is anchored off Bedloe's Island. She comes here to lay the link which will complete the new European cable. The "Mackay-Bennett" came from Halifax by way of Newport, R. I. She is commanded by Captain Schenck, who has had charge of the great work of laying the cable to Nova Scotia. It was expected that in a day or two her crew of 79 men would begin to lay the shore end of the cable from Coney Island Point up through the Narrows, and thence up the bay to the city. The Commercial cable is said to be the greatest achievement of Mr. Mackay's life. The high rates charged by the cable monopoly led him to consider the advisability of laying another cable. The cables were foreign. Mr. Mackay decided that the United States ought to have a cable. Then Mr. Mackay and James Gordon Bennett decided to lay the new cable. Mr. Mackay placed abundant means at the disposal of the Commercial Cable Company and he and Mr. Bennett assumed all risks, and in a few days the work from Norton's Point to New York city will be completed.

What Paper Is Made Of.

Paper is one of the most lavishly used articles of modern times. The materials of which it can be made are almost as numerous and common as the uses to which the finished article is put.

There are something over 2,000 patents covering the making of paper. It may be manufactured, under some one of them, from the leaves of trees; from hop plants, bean stalks, pea vines; from the trunks and stems of Indian corn and every variety of grain; from moss, clover and timothy hay, and more than 100 kinds of grasses; from straw and cocoanut fibre; from fresh water weeds and sea weeds; from sawdust, shavings and asbestos; from thistles and thistle down; from banana skins, tobacco stalks and tan bark; from hair, wool, fur, old sacking or bagging and from almost any other imaginable refuse.—*Kate Field's Washington.*

Lightning Made Him a Colored Man.

A dispatch from Trimble, Tenn., contains the following remarkable (if true) incident under date of August 4:

Bill Goldby and Spencer Mills took refuge under a poplar tree during a thunderstorm. Lightning struck the tree and severely stunned both of them. After the tree was struck a heavy rain set in, and for several hours the men lay unconscious, exposed to a beating rain. When consciousness returned, Goldby and Mills arose, stiff and sore, and when the latter looked at his companion he was horrified to discover that his skin had been turned as black as that of an African, and it has remained so ever since. Mills' skin was not affected in the least; and the coloring of Goldby's skin is the only ill effects of their narrow escape from death.

Advertising in the "Electrical Review" Pays.

A prominent New England manufacturer writes to the ELECTRICAL REVIEW as follows:

"We have had an order come in from New Orleans enclosing our advertising cut in the ELECTRICAL REVIEW, and this morning a farmer down in Stockbridge, Mass., wanted three of the articles advertised. We are glad to see that you reach all classes of readers. Business is improving, and the fruits of continuous advertising are being garnered now."

Specifications for Vestibuled Electric Railway Trains.

Charles C. Caldwell, electrical engineer, P. O. Box 703, Shelbyville, Ind., has sent to the ELECTRICAL REVIEW a copy of specifications he has drawn up for vestibuled electric railway trains intended for interurban electric railway service. The circular seems to invite bids for constructing five trains of two cars each, as specified, but the name of the road they are intended for is not mentioned. If any of the readers of the ELECTRICAL REVIEW are interested in the matter, they might write for further particulars to Mr. Caldwell, whose address is given above.

Opening of the New Netherland.

Messrs. Stafford & Whittaker formally opened the New Netherland Hotel Wednesday evening of last week in a style befitting this most magnificent building. These gentlemen have so successfully managed the Hotel Imperial, at 32d street—which has long been the electrical headquarters of the city—that the public will expect to see the same progressive hotel ideas obtain at the New Netherland on 59th street. Messrs. Stafford & Whittaker now own three leading and paying hotels—the Imperial, Grand and New Netherland.

It Will Rain if the Dynamos Stop!

[*From the N. Y. Sun.*]

TO THE EDITOR OF THE SUN—*Sir:* In order to stop this unprecedented drought, let the government order the dynamos in the New England and Middle States, including Maryland and Virginia, to be stopped 48 hours, when there will be a heavy rainfall. The reason for this is that the atmosphere is kept so continually surcharged with artificial electricity that it dissipates the humidity by decomposing. Stop the dynamos.

D. W. H.

A man of Tennessee has been turned into a colored man by a stroke of lightning. A writer in the New York *Sun* says that all the dynamos of New England must cease running for 48 hours to stop the drought in that section by keeping electricity from floating upwards and dissipating humidity. With electricity descending and transforming Caucasians into Africans, and electricity ascending and knocking out Jupitus Pluvius, we venture to remark that electrical wonders never cease!

THE RISE OF ELECTRICITY.

AN HISTORICAL ESSAY BY DR. J. MOUNT BLEYER, OF NEW YORK, FELLOW OF THE ROYAL ACADEMY OF MEDICINE OF NAPLES, MEMBER OF THE AMERICAN MEDICAL ASSOCIATION, THE AMERICAN ELECTRO-THERAPEUTICAL ASSOCIATION, ETC.

[*Specially written for the* ELECTRICAL REVIEW.]

To wield the thunderbolt was the marked attribute of the chief gods of old; the lightning flash was the surest proof of the presence of the Divinity. Indra, the Jupiter of the Hindoos, was the god of thunder; the Etruscan Tinia always guided the electric storm; Jupiter Tonans waved his thunderbolt over trembling Rome, and in every form of ancient superstition a belief in the divine origin of the most startling of the heavenly appearances lay at the base of the national faith. When it thundered, the grave Romans dissolved their political meetings, the wise Greeks listened with unfeigned awe. The gods spoke from the heavens in the rattle of the passing storm, or wrote their rage upon the earth in the ruin of the lightning stroke. And now, like Indra, Tinia, or Jupiter, the genius of modern civilization bears in its right arm the thunderbolt as its crowning attribute. It has snatched the lightning from the skies and made it the most docile of servants. The electric flash is busy day and night in doing the work marked out for it by our modern magicians. It flies swifter than Ariel to carry its master's message, and puts a girdle round the earth. It dives in mid-ocean; rides over desert and forest; it prints our books, prepares our paper; it dissolves our gems and consumes platinum. An electric light turns night into day; electric processes aid almost every kind of mechanical labor, and the thunderbolt of Jupiter is everywhere toiling in the cause of human progress.

Of all the achievements of modern civilization this is the most remarkable. Steam is gross and material; there is little that is poetic or great in the rattle of the train or the roar of a monstrous engine. We can easily account for the mightiest of machines impelled by boiling water. Gunpowder and nitro-glycerine, oxygen and hydrogen, seem the natural servants of inventive man. But when we attempt to catch the idea of the electric spark, it still appears almost as superhuman and terrible as when it flashed fear into the hearts of Greeks and Romans. It obeys with scrupulous accuracy; it performs the smallest as well as the most important tasks with equal care; it is as docile as was the genie to Solomon's seal; and yet it still remains shadowy, mysterious and impalpable. It still lives in the skies and seems to connect the material and the spiritual. Whence come these tongues of fire, these sharp shocks, these pale, ghostly lights that play around us and mock the master they obey? Who is it that wields this electric element which seems to be the very base and source of our existence.

Some such sentiment of mysterious awe pressed upon the mind of Thales, the Franklin of Miletus, when 25 centuries ago he probably discovered electricity.* A sage of Greece, the philosopher's keen eye watched the minute phenomena of nature. His mind was eager for every kind of knowledge. He studied morals, metaphysics, life; and upon a narrow field of facts he created vast fabrics of speculation, which were designed to embrace the whole origin and destiny of man. Phœnician voyagers, who were in the habit in that dim age of sailing out of the straits of Hercules, and perhaps of coasting along the desolate shores of Europe until they reached the Baltic, brought back from the savage seas of Prussia a substance greatly prized by the ancients for its fair color and delicate transparency. It was amber, or electron.† The natives found it floating upon the waves, or perhaps gathered it from the mines which still form a source of the wealth of Prussia; and the amber imported from the distant North was an important article of commerce with the southern natives. But to Thales it possessed a mysterious value. He discovered that electron when rubbed had the property of attracting to itself various light articles, as if endowed with volition. His discovery was the first step in the great science of electricity. But the philosopher did no more than record his observation and attempt to account for it, as he had already done with the magnet, by ascribing to amber a soul. He supposed that some hidden principle of life lay in the yellow jewel from the northern seas.

The discovery was never forgotten, and the peculiar property of amber was noticed and commented upon by various ancient philosophers. Theophrastus, three centuries later than Thales, observed the attractive power of electron, and perhaps lectured his 2,000 disciples upon the animated gem. Pliny, the elder, also describes the phenomenon, and believed, apparently, that the amber was rubbed into life by the action of his fingers. But the germ of the great science lay hidden in mystery. No ancient philosopher could for a moment have supposed that there was any connection between the animated electron and the wild electricity of the thunderstorm; that the same power was active in both; and that the secret of the amber was that of the thunderbolt of Jove; that the precious electron was to create and to give a name to the most wonderful of modern discoveries.

Yet electricity, in all its varied phenomena, never suffered the puzzled ancients to rest.‡ It flashed along the spears of their long array of soldiers, and tipped every helmet with a plume of flame. It filled even the immovable Cæsar with a strange alarm. It leaped down from the clouds and splintered the temples and statues of Rome, and did not spare the effigy of the Thunderer himself. It was seen playing around the ramparts of fortified towns, crowning their sentinels with a strange effulgence. Often the Roman or Greek sailors, far from land on the stormy Mediterranean, saw pale spectral lights dancing along the ropes of their vessels or clinging in fitful outlines to the masts, and called them Cæsar and Pollux. But the science of electricity was still unborn. Meantime, in ancient Etruria, the parent-land of Italian superstition, countless students were being instructed in the art of reading by the lightning of the will of the gods.* The heavens were divided into various compartments. If the lightning flash appeared in one, it was a favorable omen; if in another, it was fatal. The accomplished augurs, instructed by long years of study and toil, stood upon lofty towers, watching for the sudden gleam or a peal of thunder, and knew at once by their divine art what undertakings would be successful, and when their warriors, clad in brass, should go forth to battle against Rome. The religion of ancient Etruria was almost a worship of electricity, and the land of Galvani and Volta was famous in the dawn of its history for the close study of electrical phenomena.

But no Tuscan augur or Roman priest made any progress in creating the science. Centuries passed away; Europe was torn by civil convulsions; men sank into barbarism and rose again into new activity; but the famous observation of Thales was never lost; and at length, in the opening of the Seventeenth Century, an Englishman named Gilbert began to study the properties of the electron. He was rewarded by a series of discoveries that, in the dawn of science, made his name famous over Europe.† Yet they were so meagre as to advance little beyond the early observations of Pliny. He enumerated various substances capable of producing electrical action; he noticed the influence of the weather on the electron and the magnet; and from his labors sprang up a science known as Electricity. Gilbert's work, "De Magnete," was published in 1600, and soon the new science began to terrify and astonish men. Every fact, as it was unfolded, seemed spiritual and supernatural. Flames of fire played around the electrical substances in the dark; sparks glittered; sharp sensations, produced by the unknown agent, were felt by astonished operators; and a mysterious awe surrounded the birth of the wonderful principle. Men were almost inclined, like Thales, to invest the electrical substance with a soul.

An Englishman discovered electricity; a Prussian, in the land of amber, invented the first electrical machine. Otto Guericke, of Magdenburg, who also invented the air pump, formed the instrument by which electricity could be most readily produced. He placed a globe of sulphur on an axle, to be turned by the hand of the operator, while with the other he applied a cloth to the sulphur to produce the necessary friction. It was a rude, imperfect machine, but it was at once found to have made a great revolution in the science. Electricity, which had heretofore been known only in its feebler forms, was now given out in sharp sparks, and displayed a thousand curious properties. Sometimes it attracted objects, at others repelled them. It seemed at times to exercise a kind of volition. The weather effected it sensibly; dampness dissolved its strength; it was capable, too, of influencing bodies at a considerable distance, and was apparently independent of the usual laws of space. Yet the Seventeenth Century glided away, with its fierce religious wars and its wonderful voyages and settlements, while little progress was made in the knowledge of electricity. Newton paid no particular attention to the new science. He suggested, however, that the electrical substance was a subtle ether, filling nature, which could be set in motion by friction. Yet his bold, inquisitive mind was never strongly attracted by the mysterious study; the flashes and sparks of the electrical machines seemed, perhaps, a puerile entertainment to the great student of nature's laws. Nor did any other eminent philosopher of the age suspect that human hands would ever wield the thunderbolt or unfold, by the aid of a globe of sulphur, the mightiest principles of nature.

But in the next century electricity sprang at once into startling importance. A series of wonderful discoveries aroused the attention of almost every scientific mind in Europe. England again led the way in the path of investigation. Hawkesbee invented the glass electrical machine; a great improvement upon that of Guericke; and in 1730 Steven Grey began a course of experiments that unfolded the leading principles of the science. France took up the study, and the curious discoveries of Dufaye and Nollet excited the wonder of their contemporaries. Dufaye transmitted the electric spark through a cord 1,300 feet long; and at length, in conjunction with the Abbé Nollet, he performed an experiment with wonder and terror, that seemed the crowning mystery of the science. Dufaye suspended himself by a silken cord, and was then filled with electricity by the abbé. He presented his hand to his companion, half doubting the truth of his own speculations, when a brilliant spark shot from one philosopher to the other, and filled both with an equal surprise. Never had such a wonder been seen since the days of the Gothic warrior Walimer, who, according to Eustathius, flashed out sparks from his body, or the ancient philosopher who could never take off his clothes without emitting flames of fire.*

Not long after, however, an event occurred that seems to have filled Europe with still greater wonder and awe. It was known as the Leyden experiment. Professor Muschenbroek, who wrote an account of it to Reaumer, can scarcely express in language the agitation and terror into which his unheard of sufferings had thrown him. He had felt the first shock of electricity prepared by human hands, and not the whole kingdom of France, he declared, could induce him to take another. He had been struck in the arms, shoulders and breast, and it was two days before he recovered from the mysterious blow. The professor, in fact, had invented the Leyden jar. He had been endeavoring for some time to inclose electricity in a safe receptacle from which it could not escape, except with his permission, and at length succeeded in imprisoning the genie in a glass vessel partly filled with water. Suddenly he formed a connection between the two surfaces of the jar.† The imprisoned electricity sprang through his body and shook him with a wild convulsion. Novelty added its terrors to the unseen assault; his imagination was filled with an indefinite alarm; he shrank from his glass bottle as if it were tenanted by the devil. Yet we soon after find him recovering his spirits and once more experimenting upon his powerful instrument. The electric jar was soon employed in all the laboratories of Europe, and everywhere terrified philosophers by the vigor of its shocks. One lost his breath and believed that his right arm was forever disabled; Professor Winkler was thrown into convulsions and had recourse to cooling medicines to avoid a fever; Abbé Nollet received a severe blow—his body was bent, his respiration stopped and he dropped the glass jar in terror. Yet the shock of the Leyden vial soon

* Becquerel, "Traité de l'Electricité," i, Pliny, N. H., p. 37, 329.

† Ges Carthager. Bötticher, p. 75, thinks the Phœnicians reached Prussia. See Pliny, N. H., iv, p. 27; xxxvii, p. 11, 12.

‡ Becquerel, i, p. 32. Plutarch, Lysander, notice the luminous wonders.

*Müller, "Etruska," iii, p. 1, 2. Arnob, vii, p. 26. Genétrix et mater superstitionis Etruria.

†Becquerel, i, p, 35.

*Grey seems to have anticipated the experiment. Priestley's, Hist. Elect., i, p. 66.

† Priestly, i, p. 153.

became the favorite amusement of court and saloon. It was exhibited before Louis XV, at Versailles, and a chain of 200 persons having joined hands received at once the mysterious blow. Each was severely shaken and it was curious to observe, says a contemporary account, how the peculiar temperament of every individual displayed itself in the moment of terror.* Soon itinerant electricians wandered over Europe astonishing the unlearned and the rustic by administering electric shocks from the Leyden jar; and the mysterious machine became familiar to the people as well as to the court. The jar was improved by coating its sides with a thin metallic covering; its power was increased, it was used in medicine to revive the paralytic, or to open the lips of the dumb; long sparks were drawn from it that resembled flashes of lightning and that killed unfortunate little birds; a battery of jars was at length invented by Franklin that gave shocks that reminded one of the terrible power of the thunderbolt; and the whole scientific world felt that it stood on the brink of some unparalleled discovery.

The Franklin was already born, and his name had now grown great in the science.† His mind was of a peculiar cast, that recalled the vigorous simplicity of the Greeks. He was a modern Solon, a speculative Thales. He had wandered away from Boston a printer's apprentice, and had found employment and success in Philadelphia. From his parents he had received no inheritance except the noblest—a spotless example, a healthful constitution, a sane mind; and after a vigorous struggle and several failures, the philosophic printer had won the respect and the attention of his fellow-townsmen. He founded schools, libraries and various useful institutions in his adopted home, and at 45 had become one of its most useful citizens. Still Franklin lived obscure except to his narrow world, and his eminent powers had won him no general renown. He had, perhaps, pleased himself in his youth with the hope of excelling in letters; he had formed his style by a careful study of Addison; he wrote clear and sensible essays that showed the purity of his taste and the weakness of his fancy; and yet in literature he had been far excelled in notoriety, if not fame, by his unprincipled companion, Ralph. Franklin's rare humor, the wit of a philosopher, shines out in his "Busy-Body," his "Almanac," his "Ephemera," or his famous "Whistle." He uttered keen apothegms that live like those of Solon, and sharp satires that want the bitter hopelessness of Diogenes. But his literature scarcely possessed the shining marks of genius, and was plain, cold and lifeless. He was an excellent writer, but he was never great.

His genius, like Bacon's, lay in his power of swift induction from moral or physical facts. In morals he was the wisest of his contemporaries. He taught youthful mechanics that "Time is money;" that "Credit is money;" that purity, honesty and self-respect were better than wealth, luxury, or any other success. His own labors were increasing; he wrote, toiled, thought incessantly for his fellow-men. He was noted and observed for his modesty and discretion. His acute mind was ever seeking for useful novelty in science and in conduct; and hence when Franklin came to stand before mankind, covered with his splendid scientific renown, and the representative of the new republic that seemed about to receive the classic refinement of a better age, he was received in the Courts of Europe as a worthy successor of the philosophers of Athens and Ionia. As Washington appeared before the world clothed in the purity, the probity, the valor of a Fabricius or a Cato, so Franklin was universally compared with the acute sages and philosophers of Greece.

To Franklin electricity owed the most wonderful of all its acheivements in the Eighteenth Century.* The obscure provincial was led by an accidental circumstance and his own eager fondness for knowledge to enter upon the study of the new science. Peter Collinson, a member of the Royal Society, sent over an electrical machine to Philadelphia, and Franklin at once commenced a series of experiments that led to remarkable results. Never, he wrote to Collinson in his first letter, March 28, 1747, had he been so engrossed by any pursuit.† All his leisure moments were given to his machine. His fellow-townsmen thronged his rooms to watch his novel researches. His labors were rewarded by constant discoveries, and his wonderful inductive powers soon led him to unfold, in his admirable style, the hidden principles of the science. In 1747 he commenced writing to Collinson, in a series of letters, an account of his researches in electricity. He gave clear directions for the performance of various beautiful or instructive experiments that were wholly new and surprising. He explained the phenomenon of the Leyden jar, he showed how iron points attracted electricity, and at length he declared that the lightning and the thunder were produced by the same agent that was inclosed in the mysterious bottle, and he urged the English philosophers to draw down the electricity of the skies by placing iron points upon towers or poles and thus test the accuracy of his theories. His suggestions, it is related, were received by the Royal Society with shouts of laughter. They refused to print Franklin's papers in their Transactions, and they seem to have looked upon his speculations and experiments as scarcely worthy of notice. They thought them the silly dreams of an ignorant provincial.‡

Fortunately, however, for science and mankind, Collinson was more intelligent and saw at once the value of Franklin's researches. He published the letters and they drew the attention of Europe. Buffon read them in France and persuaded his friend Dalibard to translate them into French; Franklin's rare and beautiful experiments were repeated in Paris; Louis XV and all his court hastened to see them and were charmed and amazed at Franklin's genius and the wonders of the new science; public lecture rooms were opened for their performance, and all Paris thronged to the rare exhibition. The letters were translated into many languages and suddenly the name of the obscure printer in Philadelphia became one of the most renowned in the annals of science. His theories were assailed by the Abbé Nollet and a party of the French philosophers, but they also found many defenders; and a large school of enthusiastic men of science, struck by the vigor of Franklin's genius and the novelty of his discoveries, assumed the name of Franklinists.

Still, however, Franklin's most daring speculation as to the unity of the electricity of the earth and the air, which had awakened the derision of the whole Royal Society, remained untested by experiment, and the philosopher prepared with doubt and dismay to attempt its verification. He felt that his fame must rest upon his success. If he could draw down the lightning from the skies by presenting his iron points to the thunder-cloud, he must attain a renown that would live forever. If he failed, by the incompleteness of his instruments or any unlooked-for accident, he would seem to merit the scorn which European philosophers were prepared to pour upon the presuming provincial. Philadelphia, too, offered no convenient tower or steeple on which to fix his iron points, while the modest inquirer was probably anxious that his first experiment should be made with no one present to witness his possible failure. His inventive mind suggested a simple expedient.* He formed a common kite from a silk handkerchief stretched upon two cross sticks. On the upper part was placed the iron point; the string was of hemp, terminating in a short silken cord, and at the end of the hempen string hung an iron key. Such was the simple apparatus with which the philosopher set forth from his home, on a cloudy day in June, 1752, to draw the lightning from the skies, to penetrate a mystery upon which ages had meditated in vain. He took his son with him as the only witness of his secret adventure. As the rain was falling he stood under a shed and raised his kite. It was, no doubt, a moment of strong and unprecedented excitement, and we can well imagine that Franklin watched his kite slowly ascending with a keener interest than Etruscan augur or Roman priest had ever felt as he awaited the omen of the gods. A cloud passed over. No trace of electricity appeared. The heart of the philosopher sank with dismay. But suddenly the falling rain made the hempen string an excellent conductor, and Franklin said that its fibres began to be stirred by some unusual impulse. He applied his hand to the key and at once drew sparks from the skies. He felt that he had triumphed, but the first thought of his generous nature, no doubt, was how to make his discovery useful to mankind, and one can scarcely avoid lamenting that no vision reached him in the moment of his victory of that wonderful instrument with which another American philosopher has girdled the earth and made electricity the guardian of civilization.

Before his own success, Franklin's theory had already been tested and proved in Europe.† The French king, Louis XV, was a strong Franklinist, and urged Buffon and the other philosophers to try the experiment of the iron points, according to Franklin's directions. On the 10th of May, therefore, Dalibard erected a bar of iron 40 feet long at Marly, and succeeded in drawing electricity from a thunder-cloud. It should be remembered, too, that the Abbé Nollet had suggested the connection between lightning and electricity before Franklin wrote, and that the idea had arisen in the minds of other philosophers. Yet Franklin could not have been acquainted with their theories, and no one before him had ever suggested any means of forming a connection with the thunder-cloud. His theory and his method were altogether original.

(To be continued.)

* Academie des Sciences, 1746, p. 7.
† Spark's "Life of Franklin," i, p. 152.

* Euler, Dis. de Causa Elect., 1755, p. 27. Idem asseruit Franklinus, futura experimenta animo sagaci quasi praenuncians. See p. 132.
† Sparks, v, p. 180.
‡ Id., v, p. 175.

* Sparks, v, p. 175.
† *Gentlemen's Mag.*, 1752, p. 229, describes the new wonder.

Fighting by 'Phone.

"Er — about this coming prize fight," said the reporter.

"Well?" asked the pugilist.

"Is it to be fought with bare mouths or telephones?"—*Indianapolis Journal.*

Primary Battery Testing.

[*From London Electrical Review.*]

A very full report by Prof. A. Jamieson on a series of tests of dry cells has recently been published and is reproduced in this issue. The report is useful as indicating the value of this class of primary batteries, and it is also useful in that it shows, to a great extent, how tests of the kind ought to be carried out. The determination of the efficiency of any particular battery is not really an easy matter, as there are so many considerations involved; it is not simply a question of what output the battery being tested will give, but how it compares with others which have hitherto been in use. What is the unit of comparison to be? Is it to be bulk, weight, price, or a combination of the three? It must be confessed that it is not at all clear yet what is the most satisfactory answer to this query. Mr. Jamieson has practically taken bulk as the unit, and he is, we think, wise in having done so, and, moreover, he has taken cells of as nearly equal size as possible in making the comparisons. As a matter of fact, no other test than that of taking cells of a similar size can be really of value, for it by no means follows that if the size is increased the output should be increased in the same proportion. Of course, if a small cell gives a greater output than a larger one of another type, its superiority is obvious (the question of price being set aside, as it may happen that the smaller cell is actually more expensive than the larger one), but it is not a satisfactory report which states that "the larger cell gave a greater output than the smaller one, as might be expected," for even if dimensions are given we have (as we before stated) as yet not sufficient data to enable one to say how far output goes with bulk. Again, the particular purpose for which the cells are required is a most important element; a steady current for a few hours may be required in certain cases, and in others an intermittent one for a lengthened period. The "time" test is the most difficult one of all to deal with, and, as far as we know, there is no substitute for it; no short period test will really indicate how long a cell will keep efficient when used for such purposes as ringing electric bells. A Daniell battery will work efficiently, and will keep comparatively clean, if more or less continually worked; but keep it idle for a few weeks and its condition will then be a sorry sight. The prospect of a battery with no local action, and one which will give a continuous and steady current when worked, is yet in the dim and distant future; in the meantime we sadly want a really satisfactory system of comparison of the various types which from time to time are brought out.

A petition has been filed for a dissolution of the People's Electric Company, of Braddock, Pa. It was incorporated in September, 1892, and claims to have no debts or liabilities.

ELECTRIC LIGHT FLASHES.

Ada, Minn., is talking of putting in an electric light plant.

Erie, Pa., is clamoring for underground electric wires.

Watkins Glen, N. Y., is now lighted by electricity.

The electric light company at Waupaca, Wis., has asked the council for a 20-year franchise.

The electric light company are requested to let their light so shine that men may not only see their good works, but also across the street.—*Salt Lake City Herald.*

Benton Harbor, Mich., is said to be making arrangements to put in an electric light plant to light the city and business places for about half the rates now charged by the St. Joseph and Benton Harbor Electric Light Company. The power will be furnished by the city water works, and is to be run in connection with the city's water-power.

An informal proposition has been made by the Springfield, Mass., Electric Light and Power Company to the council for the city to take the present electric light plant at a valuation of $40,000, paying the old company an annual rental of seven per cent on that amount; that the city would run the street circuit of 147 lights and pay the company $2,800 each year in rents.

The Brockport, N. Y., electric light plant has been sold to foreclose a mortgage held by George Gordon, president of the First National Bank, for $7,500. The plant was bid in by B. H. Roberts and Charles Roberts for $11,800. This, it is said, will give the stockholders a dividend of about 20 per cent on their investment.

The streets of Little Rock, Ark., were in darkness last week, and will continue so every night for the next two weeks. Some malicious person entered the power house of the city electric light plant and poured a quart of sulphuric acid upon the four dynamos, which destroyed the insulation in all of them. The dynamos were new and cost $60,000. A discharged fireman named Baldwin and three others have been arrested.

The Charlestown, Mass., navy yard is to be equipped with an extensive electric plant. An appropriation of between $15,000 and $16,000 for this purpose is now available, and the work of establishing the plant will be commenced in a few days. The power station will be located in the great machine shop, while lamps will be distributed about the yard, in the workshops, offices, officers' quarters, and the marine barracks. In addition to this, wires will be run to the receiving ship "Wabash," which will also be illuminated with electricity.

Walter K. Freeman in Trouble.

Walter K. Freeman, who has had a varied career in electrical circles, was arrested in New York city last week on a charge of abduction. He claimed it was a blackmailing scheme. He has been remanded for trial.

OBITUARY.

Hon. George B. Shaw, a member of Congress from the Eau Claire, Wis., district, died at his home in Eau Claire on August 27. Mr. Shaw was well-known among electrical people. He was general manager of the National Electric Manufacturing Company from 1889 to 1892. He had served one term as Mayor of Eau Claire.

The Hubley Trolley Harp and Wheel.

The Hubley Manufacturing Company, of Lancaster, Pa., after a careful study of the necessary requirements, have recently placed upon the market the trolley harp and wheel illustrated herewith. Strength and lightness are given to the side bar by its crescent shaped section, which also affords a rounded surface that prevents the trolley wire being caught or damaged. An improved method of fastening the pin is employed, by which a large bearing is obtained and sharp corners are avoided. The distribution of metal is such that the wheel may be entirely worn out, while the trolley wire cannot be worn by coming in contact with the harp. Some of these wheels are claimed to have made a record of 10,000 miles.

THE HUBLEY TROLLEY HARP AND WHEEL.

The Navy Department has received a report from Naval Constructor Hichborn against the adoption of a process for electroplating the bottoms of the steel cruisers with copper. This treatment, the report asserts, would be positively destructive, as the moment the thin skin of copper was broken by contact with an obstruction, galvanic action between the copper and steel plating would ensue, and the steel would rapidily be destroyed by the salt water. A sheathing of wood covered with copper is recommended for the new cruisers.

The Sioux City, Ia., Telephone Company has applied for a franchise. It is said to be making a duplicate of the Bell instrument, which it sells outright for $15. The company will not operate a central exchange for some time, but will put up wires, which will be leased to patrons.

TELEPHONE NEWS AND COMMENT.

Bonham, Texas, wants a telephone exchange.

Decatur, Ind., will soon have a new telephone company.

Chester, Pa., will hereafter tax telegraph and telephone poles.

Several automatic telephones are in operation at Victoria, Texas.

The metallic circuit telephone line between Burlington and St. Albans, Vt., is working well.

Lockport, N. Y., citizens declare that they will not pay over $2 a month for Bell service.

A telephone system with 50 subscribers is about ready to begin business at Fairmont, W. Va.

Mr. J. Harris Ross, Washington City (of Pan-Electric fame), is now engaged in putting up the magneto telephone in villages between Washington and Baltimore.

The work of building the new telephone line from Boston to Bar Harbor, Me., is nearly completed. At the present time there remains about 14 miles of poles to be set.

A new telephone service is likely to be established in Perth Amboy, N. J., by the American Mutual Telephone Company, whose agent, it is said, has secured nearly 40 subscribers.

The Islesboro, Northport and Belfast, Me., Telephone Company expects to have the poles set and telephone connection completed between Islesboro, Saturday Cove, Northport Campground and Belfast within a year.

Mayor Pingree has been for five years endeavoring to reform Detroit, and now declares that as telephones cost $25 per year in Canada and $65 per year in Detroit he will reduce telephone rates or drive the telephone company out of Detroit.

A telephone line has been projected and is now being built between the towns of Humansville, Wheatland, Hermitage, Preston and Cross Timbers, Mo. This line is certainly needed, as Hickory County has neither railroad, telegraph nor other means for speedy communication.

A new telephone company proposes to operate in Chicago under a franchise granted to the Chicago Power Supply and Smoke Abating Company, better known as Promoter Bacon's boodle franchise. This franchise was granted ostensibly as a step toward abolishing the smoke nuisance—an end which it will readily be seen will be greatly furthered by using it for telephone purposes.

A. W. Cohen, of Passaic, N. J., is going to Japan to construct a new telegraph line for the Mikado. Arrangements are now pending between the New York and Canadian Japanese Consuls that will consummate a contract between the Japanese Government and Mr. Cohen, binding him for one year. Mr. Cohen is to take with him twenty-five expert telegraphers and linemen, who will also be bound by contract. Mr. Cohen will arrange to go to Vancouver in a few weeks.

The representatives of the Chippewa Valley Telephone Company are at work in Eau Claire, Wis. They have been well received and a list of prospective subscribers is being prepared, the announced purpose being to put in the Harrison system as soon as 300 subscribers have been secured. About 100 names are already on the list. The projectors of the new company promise a very material reduction of rates. Chippewa Falls is also to be canvassed with a view to putting in an exchange there.

The Albany, Newton and Camilla, Ga., Telephone Company has been organized with the following officers: President, T. M. Carter; manager, J. M. Solana; secretary and treasurer, T. M. Ticknor; directors, T. M. Carter, John Whitehead, T. M. Ticknor, J. M. Solana, R. L. Hall. The capital stock of the company, it is said, has already been subscribed and the connection of Albany and Newton by telephone at an early day is assured. The line will then be extended from Newton to Camilla.

The Farmers' Telephone Company, of Massillon, O., has been incorporated by Martin Card, Nathan E. Mofitt, J. H. Fisher, William Mahheimer, Andrew T. Gordon, F. Z. Groff, Robert A. Pim and Azariah Short. The nominal capital is $10,000. The company proposes to build a telephone line through the State from Cleveland to Cincinnati, passing through the counties of Cuyahoga, Summit, Stark, Wayne, Holmes, Coshocton, Licking, Franklin, Madison, Clark, Green, Montgomery, Butler and Hamilton, with branches extending into every county in the State.

The threat of the Central Union (Bell) Telephone Company to remove its instruments from the terminal station of the Farmers' (Harrison) Telephone Company, at Massillon, Ohio, raises an issue. The new company began business and declared its intention of receiving messages through its Bell instrument and repeating them through its own instrument to its own subscribers. The Farmers' company contends that the Bell company has no authority to act as censor upon any matter it transmits and that the right to repeat a message through a rival instrument is inherent and cannot be abrogated. The Central Union manager has given warning that exchange of business will not be permitted and a final ruling is awaited with keen interest.

Chloride Accumulators in Birmingham, England.

The readers of the ELECTRICAL REVIEW who saw the description some months ago of the operation of three of the street railroads of Paris, France, by chloride accumulators will be interested to hear that the Chloride Electrical Storage Syndicate, Limited, sole manufacturers in that country of the chloride accumulator, are now operating the street railroads of Birmingham, England, with chloride accumulators, replacing the Epstein batteries which were formerly in use. The chloride cells operate, it is claimed, at least 60 miles on every charge, and could do 80 miles if it was necessary, thus enabling each car to be operated with one set of batteries instead of two, as has been the practice heretofore. The English Chloride company has also supplied batteries to Messrs. Mather & Platt for use on the trolley road on the Isle of Man, running between Portevada, the Douglas terminus and the Laxey terminus. The *Electrical Engineer*, of London, says:

"*The Use of Accumulators as an Auxiliary.*—One of the most noteworthy features in connection with the line is the use of accumulators. At Groudle Glen, situated two and a half miles from Douglas, a battery of 240 cells has been erected in a building specially constructed for the purpose. These cells were manufactured for Messrs. Mather & Platt, Limited, by the Chloride Electrical Storage Syndicate, Limited, of 16 Victoria street, London. They have a capacity of 140 amperes for three hours, or 70 amperes for nine hours, and are remarkable for the exceedingly level curve electro-motive force, which they maintain up to the end of discharge, and for the very high rate at which they can be discharged without detriment. Half the cells of the battery are of the Chloride company's patent protected type, with teak separators and asbestos diaphragms similar to those now being used on the Birmingham tramways, and the other half unprotected. The cells are charged direct from the line or from a motor-generator, which is of special design, by Messrs. Mather & Platt, which gives the required additional electro-motive force. This is the first instance of accumulators being used as a fixed battery for tramway or railway work in this country, although a similar step has been taken in the case of the Zurich-Hirslanden tramway, referred to in the *Electrical Engineer* of July 20, last. The battery at Groudle Glen serves not only the function of supplying the extra power required at times of maximum demand, but it is intended during the Winter months to work the light cars, which will then be sufficient for the traffic after the close of the tourists season, entirely from the battery, which will be charged only once or twice a week, as occasion may require."

The same company recently equipped the electric launch "Aphrodite," the following description of which is taken from the London *Electrical Review*:

"On Saturday last the Goring-on-Thames regatta was held, and the new electric launch "Aphrodite" was lent to the Thames Conservancy for the occasion, and was employed for clearing the course during the day. This boat was built at Goring in Mr. A. C. Sander's boat-yard. The arrangement of the electrical details have been carried out by Mr. H. A. Earle, of Messrs. Mather & Platt, Limited, 16 Victoria street, Westminster, and the novel feature consists in the employment of a battery of chloride cells for the first time on the Thames. They are manufactured in England by the Chloride Electrical Storage Syndicate, Limited, 16 Victoria street, London, and this launch has been specially built in order to demonstrate their superiority for this class of work, their large capacity for a given weight enabling distances and speed to be run without recharging, which were previously impossible. The cells with which the "Aphrodite" is fitted are capable of being discharged at a very high rate, and, on the measured mile, a speed of nine miles per hour has been obtained, and this rate can be continuously maintained for about three hours, which is a record performance for an electric launch of this size. At slower speeds, namely, six and one-half miles per hour, which is the usual rate of travel, and which is still considerably above the average speed of electric launches of this size, a day's run of nine hours can be undertaken, inclusive of the time taken through locks. One feature of the chloride cells is that although at very high rates of discharge their capacity for a given weight greatly exceeds that of other types, their increased capacity at a low rate is still proportionately greater, and, on this account, with the reduced speed of five and one-half miles per hour, the battery power with which this launch is provided is capable of covering a distance of approximately 110 miles without recharging."

The Street Car Service of Terre Haute, Ind.

While the horses have been going their good miles at the race track this week and their sensational performances heralded from one end of the country to the other, a word of praise for the Terre Haute Electric Railway Company should not be inappropriate says the Terre Haute *Daily Express*. Since the opening day of the races the company has handled the big crowds with a degree of dispatch and comfort that speaks well for the city and street railway management. President Harrison and Superintendent Burke have been on the go almost constantly, taking a personal interest in the transporting of people to and from the race track.

Each evening when the races are finished both the president and superintendent have been at the entrance gate assisting people on the cars and moving the big crowd as speedily as possible. Notwithstanding the large number of cars put on the main line the 12-minute schedule was maintained on all branch lines. When the races were over yesterday there were 21 cars waiting at the Fair Grounds to bring the crowd in. The last car in, the new No. 53, the strongest on the line, had five trailers attached, all of which were loaded, the estimated number on this train being 700. The power capacity of the system was given a rigid test, for in addition to supplying power for the large number of extra cars, the best of service was maintained with the lighting machines, the light at the Fair Ground and Collett Park being in good condition.

They Have Metallic Circuits—That's the Answer.

TO THE EDITOR OF ELECTRICAL REVIEW:

I have noticed that some telephones in large cities are not troubled with induction. Will you please give the reason and oblige,

L. W. CASE.

Highland Park, Conn., August 28.

STREET RAILWAYS.

CONVENTION ANNOUNCEMENTS GIVING DATE AND PLACE OF MEETING.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.—SEPTEMBER 5.

H. R. Rhoads, president, Williamsport; R. L. Jones, first vice-president, Reading; S. P. Light, secretary, Lebanon; Wm. H. Lanious, treasurer, York.

Next meeting at Reading, first Wednesday in September, 1894.

OHIO STATE TRAMWAY ASSOCIATION.—SEPTEMBER 26.

President, A. E. Lang, Toledo; vice-president, W. J. Kelly, Columbus; secretary and treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, W. A. Lynch, Canton, O.

Meets at Toledo on the fourth Wednesday in September, 1894.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.—SEPTEMBER 18.

D. B. Hasbrouck, president, New York city; G. Tracy Rogers, first vice-president, Binghamton; James H. Moffatt, second vice-president, Syracuse; William J. Richardson, secretary and treasurer, Brooklyn.

The next meeting will be held at Syracuse on the third Tuesday in September, 1894.

AMERICAN STREET RAILWAY ASSOCIATION.—ATLANTA, OCTOBER, 17.

Henry C. Payne, president, Milwaukee, Wis.; Wm. J. Richardson, secretary and treasurer, Brooklyn, N. Y.; W. J. Stephenson, first vice-president, Washington, D. C.; J. R. Chapman, second vice-president, Grand Rapids, Mich; Lewis Perrine, third vice-president, Trenton, N. J. Executive Committee, D. F. Longstreet, Denver, Col.; T. H. McLean, Indianapolis, Ind.; Ed. Whittacre, W. Y. Soper, Ottawa, Ont.; and E. S. Goodrich, Hartford, Conn.

Place of next meeting, Atlanta, Georgia, third Wednesday in October, 1894.

SUBJECTS FOR REPORTS AT ATLANTA.

"Can the T Rail be Satisfactorily Used in Paved Streets?" Joel Hurt, president Atlanta Consolidated Street Railway, Atlanta, Ga.; S. Hendrie, manager Wyandotte and Detroit River Railway, Detroit, Mich.; H. J. Crowley, engineer Atlanta Consolidated Street Railway, Atlanta, Ga.

"City and Suburban Electric Railways." E. C. Foster, superintendent Lynn and Boston Railroad, Boston, Mass.

"Mail, Express and Freight Service on Street Railways." R. McCulloch, electrical engineer Citizens' Railway, St. Louis.

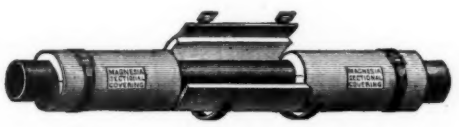
"Best Method of Treating Accidents and Complaints." John B. Parsons, general manager West Chicago Street Railroad Company, Chicago.

"Street Car Wheels and Axles." D. S. Cook, electrical engineer Trenton Passenger Railway Company, Trenton, N. J.

"Transfer and Commutation." Rodney Curtis, president Denver Tramways Company, Denver, Col.

"T Rail Construction of the Terre Haute Street Railway Company, Terre Haute, Ind." M. F. Burke, superintendent Terre Haute Street Railway Company, Terre Haute, Ind.

"A Standard Form for Accounts for Street Railways." H. I. Bettis, consulting engineer Atlanta Consolidated Street Railway Company, Atlanta, Ga.

ABSOLUTELY

FIRE-PROOF.

MAGNESIA

SECTIONAL STEAM PIPE AND BOILER COVERINGS.

THE GREAT COAL SAVER.

MANUFACTURED BY
THE KEASBEY & MATTISON CO.,
CINCINNATI: 114 West Second St. AMBLER, PA. CLEVELAND: 117 Water St.

SELLING AGENTS:
New York, Robert A. Keasbey, 54 Warren St.
Boston, S. C. Nightingale & Childs, 134 Pearl St.
Philadelphia, Macan & Co., 1420 Callowhill St.
Baltimore, Wallace & Bro., 482 E. Pratt St.
Washington, Wm. B. Morgan, Builders' Exchange.
Chicago, Kemper & Walch, 208 Lake St.
New Orleans, Delbert Engineering Co.
Memphis, Symmes & Co., 196 Front St.

SELLING AGENTS:
Milwaukee, F. Sprinkman, 133 Sycamore St.
St. Louis, F. Bocler, 108 Walnut St.
Detroit, S. P. Conkling, 20 Atwater St., East.
Denver, C. W. Badgley & Co., 18th & Market Sts.
Salt Lake City, Utah & Montana Machinery Co.
Butte City, Mont., R. W. James.
San Francisco, DeSolla & Deussing, 2 California St.

KINDRED INTERESTS

The Fort Wayne Electric Corporation is manufacturing its slow-speed alternators in large quantities. This company is pushing out energetically in all directions.

The Wise Manufacturing Company now presents its product to the extending and developing electrical field. Modesty prevents us from pointing directly to the best medium.

Telephone Manufacturing Companies now have an opportunity to show their faith in their products. An advertisement in another column should be carefully read by all of them.

Interest on Scrip of the Westinghouse Electric & Manufacturing Company due September 1, 1894, will be paid to holders of record of that date. Scrip books closed August 30 and will be opened on September 4.

Those "Detroit" Railway Motors offered by Mr. L. Warfield, of Detroit, Mich., are deserving of the attention of electric railway men in general. They are supplied complete with trucks. Full description will be sent to all who write to Detroit for it.

The General Electric Company started from its Lynn works last week what is said to be the largest electrical shipment ever made. A single train of 25 cars went from Lynn loaded with a consignment of electrical apparatus for the General Electric Company, of Portland, Ore.

The Pumpelly-Sorley Storage Battery Company, 474 The Rookery, Chicago, have issued a new circular describing their storage batteries, which contain many novel and advantageous features. They have been especially commended for telephone, electric lighting and phonograph service.

California and the Pacific Coast.—A golden opportunity is offered to parties intending to visit California. Rates are lower than usual and a weekly tourist car line over the West Shore Railroad, under the management of Messrs. A. Phillips & Company, make the trip at this time one of economy and pleasure.

"The Best Lamp on Earth" is a pointed and earnest way to announce it, and the Electric Construction and Supply Company, of New York and Chicago, thus states its faith in its arc lamps. This company is a large manufacturer, is one of the oldest in the business and knows what is required of a good arc lamp.

The New England Engineering Company, of Waterbury, Conn., is one of the busiest and best construction companies in the United States. Many of the important installations of electric light and electric railway stations have been put in by this company. They also sell Breed's emergency wagon for trolley construction and repairs—a good thing—and every electric railway should have one or more.

The Atlanta Street Railway Convention is already attracting the attention of the wide-awake manufacturers of electric railway apparatus. There will be a good attendance. The various State Street Railway Associations now meeting throughout the country, it is reported, will all be well attended, and will hold successful and interesting conventions. A list of the dates appears elsewhere.

The Larchmont Electric Company, of Mamaroneck, N. Y., have placed the contract for their power station with the Berlin Iron Bridge Company, of East Berlin, Conn. The building will be 50 feet wide and 90 feet long. The Union Metallic Cartridge Company, of Bridgeport, Conn., have also placed a contract for three large buildings with the Berlin Iron Bridge Company, of East Berlin, Conn.

RAILS—FOR SALE

These selected second-hand T Rails in good condition to relay:

60 lb. Steel, Western Pennsylvania or Eastern Ohio delivery.
20 lb. Steel, Northern Pennsylvania delivery.

If you can use any of the above, or any second-hand 30 lb., Iron Rails, for Pennsylvania delivery, write us. We sell new Steel Rails.

ROBINSON & ORR.,
419 WOOD ST., PITTSBURGH, PA.

ALTERNATING CURRENT WIRING AND DISTRIBUTION.
By
WILLIAM LE ROY EMMET, E. E.
Price, Postage Paid, $1.00.
ELECTRICAL REVIEW PUBLISHING CO.,
13 PARK ROW, N. Y.

A PRACTICAL, TERSE AND ACCURATE WORK.
REFERENCE BOOK
OF
TABLES AND FORMULAS
FOR
Electric Street Railway Engineers.
COMPILED AND ARRANGED
By E. A. MERRILL,
Author of "ELECTRIC LIGHTING SPECIFICATIONS."
FLEXIBLE MOROCCO COVERS, 96 PAGES.
PRICE, $1.00.
Sent post free on receipt of price by the
Electrical Review Publishing Co.,
13 PARK ROW, NEW YORK.

ROYCE & MAREAN,
DEALERS IN
Electrical Supplies,
WASHINGTON, D. C.

ELECTRIC LAUNCHES BUILT COMPLETE, $1750. UPWARDS.
THE GENERAL ELECTRIC LAUNCH CO.
44 BROAD STREET, NEW YORK.
ELECTRIC EQUIPMENTS FOR ROW BOATS $320. UPWARDS.

MY WIFE CANNOT SEE HOW YOU DO IT AND PAY FREIGHT.
$14 Buys our 2 drawer walnut or oak Improved High Arm Singer sewing machine finely finished, nickel plated, adapted to light and heavy work; guaranteed for 10 Years; with Automatic Bobbin Winder, Self-Threading Cylinder Shuttle, Self-Setting Needle and a complete set of Steel Attachments; shipped any where on 30 Day's Trial. No money required in advance. 75,000 now in use. World's Fair Medal awarded machine and attachments. Buy from factory and save dealer's and agent's profits.
FREE Cut This Out and send to-day for machine or large free catalogue, testimonials and Glimpses of the World's Fair.
OXFORD MFG. CO. 342 Wabash Ave. CHICAGO, ILL.

WHITE-CROSBY CO.,
CONTRACTING ENGINEERS,
Equitable Building, Baltimore, Md.
New York Office, 29 Broadway.
Chicago Office, The Rookery.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Rooms 136 and 137, 1 Broadway, NEW YORK.
Creosoted Lumber, Underground Conduits. Telegraph Poles, Piling and Ties Furnished.

ELECTRIC CONDENSERS.
WM. MARSHALL,
Manufacturer.
STANDARDS A SPECIALTY.
709 LEXINGTON AVENUE, NEW YORK.

H. WARD LEONARD & CO.,
BULK ELECTRICAL CONTRACTORS,
136 Liberty Street, New York.

ELECTRICITY

DIPLOMAS AWARDED. Courses in other trades, all including thorough instruction in Mathematics and Physics. Send for FREE Circular, stating subject you wish to study, to The Correspondence School of Industrial Sciences, Scranton, Pa.

BEST FOR ALL
Electrical Work
PATENT PERFORATED
ELECTRIC
LEATHER BELTING
CHARLES A. SCHIEREN & CO.,
Patentees and Sole Manufacturers.
47 Ferry Street, New York.
226 No. Third Street, Phila.
46 So. Canal Street, Chicago
119 High Street, Boston.

ALFRED F. MOORE,
MANUFACTURER OF
INSULATED ELECTRIC WIRE
FLEXIBLE CORDS AND CABLES,
200 and 202 North Third Street, PHILADELPHIA, PA.

THE WYCKOFF PIPE CO., INCORPORATED,
Williamsport, Pa.
Creosoted Wyckoff Tubing for Underground Electrical Work.

BAKER & CO.,
Importers, Melters and Refiners of
PLATINUM,
408, 410, 412 and 414 N. J. R. R. Ave., NEWARK, N. J.
Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased.
NEW YORK OFFICE: 121 LIBERTY STREET.

New York and New England Railroad.
ELECTRICIANS AND OTHERS IN TRAVELING BETWEEN
BOSTON AND NEW YORK
SHOULD ALWAYS USE
THE "AIR LINE LIMITED"
Leaving Either City 3 P. M., Due at the Other 9 P. M., EVERY DAY IN THE YEAR.
Buffet Smokers, Parlor Cars and Coaches. Dining Car between Boston and Willimantic.
TICKET OFFICES:
IN BOSTON: 322 WASHINGTON STREET. STATION, FOOT SUMMER STREET.
IN NEW YORK: 353 BROADWAY. GRAND CENTRAL STATION.
GEO. F. RANDOLPH, Gen'l Traffic Manager.
W. R. BABCOCK, Gen'l Passenger Agent.